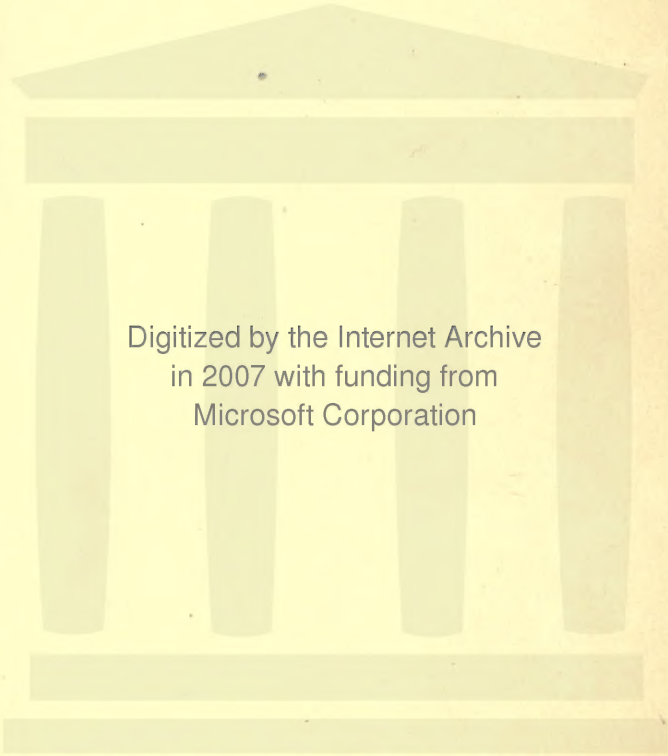
IE OPHTHALMOLOGY OF GENERAL PRACTICE

Malcolm Hepburn



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BY

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PREFACE

DURING the earlier part of my professional life I was engaged for several years in a busy general practice. Always interested in Ophthalmology, and with a certain amount of special training, I endeavoured to turn this knowledge to account, but was soon forced to realize my limitations in this respect. Unfortunately, the patient too often does not recognize such limitations, but expects his medical man to be an expert in all branches of medicine and surgery.

In my difficulties I consulted various well-known textbooks on Ophthalmology, but in vain. They gave me excellent advice as to treatment in cases I was unable to diagnose; they appeared to me, in fact, to proceed on the assumption that I knew more than I really did, and, in order thoroughly to understand many parts of these works, a good deal of preliminary study was necessary, the time for which I could ill afford. I therefore reluctantly gave up treating diseases of the eye altogether.

I do not defend that attitude. I am convinced, indeed, that the general practitioner can and ought to undertake treatment and give advice in many ophthalmic cases; and even when he does not profess to do so, he may occasionally find himself in a position in which he will be forced to express an opinion and initiate some line of treatment.

Preface

My own experience of the needs of the practitioner has been my guide in writing this volume, and I commit it to the press in the hope that, without making any considerable demand upon his already over-taxed time, it may help him to distinguish between cases which he can treat himself and those which he must refer to a specialist, and, in both groups of cases, may give him the practical guidance which he requires.

MALCOLM L. HEPBURN.

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THE OPHTHALMOLOGY OF GENERAL PRACTICE

CHAPTER I

EXAMINATION OF THE EYE

I WOULD strongly urge upon the general practitioner the importance of making himself familiar with all the methods of ocular examination. My experience of general practice has taught me that all mistakes in diagnosis are the outcome of imperfect knowledge of how to collect the various data which are necessary to the formation of an opinion not only as to which part of the eye is affected, but also regarding the complications and sequelæ likely to ensue from any particular disease or injury.

The examination of the eye is conducted on principles so different from those employed in ordinary surgical and medical diagnosis that the help to be gained from the latter is practically valueless; and the practitioner must therefore be prepared at first to approach the subject with his mind wholly detached from other branches of medicine and surgery. It is only after the ocular diagnosis is actually made that the relationship between ophthalmology and general medicine and surgery can be considered, with a view to the institution of successful treatment, and then the full significance of this connexion in many cases becomes apparent. Therefore I advise the practitioner not to waste his time in reading the

chapters describing the various affections of the eye until he has thoroughly mastered and mentally digested the contents of the first four chapters. My object in the following pages is to save him the time and trouble of searching through a treatise on Ophthalmology (however abbreviated) to find there the condition he may happen to be faced with. Rather would I help him to be practically so sure of his diagnosis that he will know what part of the work to consult, and there, if necessary, discover the line of treatment to be adopted, and the complications and sequelæ to be expected. In any case of doubt a careful and systematic examination should be made of all structures connected with the eye according to the methods now to be described, beginning with the superficial parts.

The examination must be deliberate and methodical, and although the history of the case must be patiently investigated and recorded, nothing must deter the practitioner from carrying out the usual routine examination in every detail.

Equipment.—The equipment necessary for conducting a proper examination of all parts of the eye is as follows :—

1. Snellen's test-type card, arranged both for 6-metre and 5-metre distance, and a Jaeger type-reading card.
2. A box of lenses. A small one only is necessary, with convex and concave glasses up to 12 D, the smaller degrees being also graduated in 0·5 D, while the higher ones above 9 need not have increases in strength of less than 1 D. If the practitioner wishes to order glasses for errors of refraction he must have a larger and more expensive box, containing lenses up to 20 D, together with cylinders and prisms.
3. A trial frame.

4. An ophthalmoscope, with a + 13 D lens, usually sold with the ophthalmoscope for use in the indirect method of examination, and for directing oblique illumination on to the eye in examining the external parts.
5. A small pocket lens of 12-diameters magnifying power.
6. A bottle of 2-per-cent. fluorescein.
7. A bottle of 3- or 4-per-cent. cocaine.
8. An electric lamp, if possible on a stand so that it can be moved up and down and adjusted to various heights necessary for the proper examination of the eye, while the patient is seated on a chair near it.
9. Glass rods, cotton-wool, etc.

These, with the intelligent use of his hands and eyes, should enable the practitioner to arrive at a fairly correct diagnosis.

For purposes of diagnosis, ocular diseases may be divided into two groups:

1. Diseases of the eye in which there is some external evidence of the part of the organ that is affected.

2. Diseases of the eye or defects of sight which offer no visible external signs. These may be subdivided into (*a*) errors of refraction, (*b*) intraocular disease, though both may, of course, be present in the same case.

1. Examination for Diseases with External Evidence

The **supraorbital ridge** should be palpated for any swelling, either inflammatory or a new growth, caused by periostitis or disease of the sinuses surrounding the orbital cavity. The finger can easily be passed into the orbit between the margin and the eyeball for an appreciable distance; any difficulty experienced in this respect in-

dicates some swelling proceeding from the interior of the orbit.

The **lacrymal gland** occupies the sulcus just inside the upper orbital margin on the outer side, and when the finger cannot easily be passed between the bone and the eyeball in this situation an affection of the lacrymal gland is indicated. Any inflammation of the gland is especially tender, almost the slightest touch being resented.

Proptosis, or prominence of the eyeball, is a common accompaniment of all orbital diseases, and its presence or absence is decided in the following way. The patient is seated in a chair, and the surgeon stands behind looking down on to the face from above. While the patient looks straight in front of him the surgeon lifts each upper lid with the forefinger of each hand, and arranges himself so that he can just see the front of the cornea of the normal eye projecting slightly beyond the level of the upper margin of the orbit; then, without moving his head, he turns his eyes to look in the same manner at the affected eye; if the cornea in this eye projects farther than the other, there is proptosis.

Enophthalmos is proved by placing a card edgewise in contact with the malar bone below and the upper margin of the orbit above. By comparing the proximity of the cornea to the edge of the card on the two sides, the presence of enophthalmos can be verified. It signifies shrinking of the eyeball, or fracture of the lower floor of the orbit, probably following a blow.

The **condition of the orbit** must be examined by keeping in mind the following signs, viz. (1) proptosis, (2) limitation of movement of the eyeball, (3) chemosis (œdema of the conjunctiva), (4) the appearance of the fundus, and particularly of the optic nerve. Which of the signs is the most pronounced when more than one is present, and in what degree they are associated, depend upon the nature of the orbital disease. It may be intraorbital cellulitis,

tumour of the optic nerve, inflammation and swelling of any of the tissues surrounding the orbit, cavernous-sinus disease, new growth, or exophthalmic goitre.

The **palpebral aperture** should be examined for any difference in shape, any inability to close it properly—e.g. facial paralysis, and the position of the eye in relation to the opening—e.g. squint.

The **movement of the eyeballs** can be tested by asking the patient to follow an object moved about through the various parts of the field of vision. This is not necessary in every case, but is required when diplopia is complained of or any weakness of the muscles is suspected, etc.

The **lids** must be examined externally as well as their conjunctival surface. Any convexity of the upper lid outwards instead of the presence of the normal infolding is characteristic of sequelæ of diseases of the conjunctiva, such as longstanding blepharitis, and trachoma, which eventually attacks the tarsal plate and produces contraction and folding inwards. Ptosis may be congenital, when it is generally one-sided, or it may be an early sign of myasthenia gravis, or, again, it may be one of the signs of third-nerve paralysis.

Look carefully along the edge of the lids for any signs of inflammation or for any lashes which may be growing inwards instead of outwards. A magnifying pocket lens is necessary for this, and often the explanation of a troublesome corneal inflammation, which has not been successfully treated, can be explained by the presence of an ingrowing lash which has been constantly scratching over the cornea for some time.

Examination of the conjunctival surface of the lids will now be described. The method adopted for the **lower lid** is easy enough ; merely ask the patient to look upwards, and place the forefinger on the skin surface close up to the lashes and pull downwards ; the lower conjunctiva can then be thoroughly explored right to the fornix.

Eversion of the upper lid is essential in examining for foreign bodies or to determine if possible the cause of some obscure form of conjunctivitis. It can be effected in several ways, either with one hand or with both, but it requires a little dexterity. Once it is thoroughly understood, the *one-handed method* is by far the easiest, and is carried out thus: Ask the patient to look down towards the ground; this is the first step. Any attempt to evert the lid, unless the patient does his part, is utterly futile, and it would be better to abandon this method altogether and try one of the others. If, however, he keeps his eyes in this position, nothing is easier than to evert the lid with one hand. Carry out the manœuvre by using the right hand for the left eye and the left hand for the right eye. Place the tip of the forefinger on the outer third of the upper lid and the thumb on the outer part of the lower lid; then, while the patient is looking down, it will be found quite simple to push the edge of the lower lid under that of the upper. When this is done it will be found that the thumb can be easily transferred from the lower lid to the conjunctival surface of the upper one. We now have the edge of the lid between the finger and the thumb, and by a slight movement of pulling forwards and rotation round the edge of the forefinger, which is at the same time pushed slightly backwards, the upper lid becomes folded over the forefinger and so everted. The first finger can then be transferred to the conjunctival edge, and by slight pressure against the eyeball one can keep the lid everted as long as is necessary for a satisfactory examination.

If two hands are used, place the thumb of one hand on the upper margin of the orbit so that the tip projects beyond the margin on to the eyelid as it covers the eye; then with the fingers of the other hand grasp the eyelashes and by means of them pull the eyelid forward and roll the edge over the thumb already fixed in position.

Instead of the thumb a glass rod may be used and placed horizontally over the outer surface of the lid; by the pull on the lashes the lid can be rotated round this in the same way as round the tip of the thumb.

It is sometimes necessary to bring the upper fornix into view. By far the best method is, while the upper lid is held everted by the forefinger as mentioned above, to place on the lower lid two fingers of the hand not in use, and with them push the eyeball slightly back into the orbit, when the folds of the conjunctiva in the fornix will fall forwards into view.

In these various ways all parts of the conjunctival sac can be thoroughly explored.

It is comparatively easy to evert the lids in young children and babies. There is generally blepharospasm, either due to true photophobia or to their resentment of interference; any slight pressure with the finger on one lid and the thumb on the other will cause the lids to evert.

The **lacrymal passages** must be investigated as to their patency. Notice whether the punctum is the normal size, or smaller than usual, and well applied to the globe; if otherwise, it is one of the causes of watering of the eyes. It may be dilated or slightly enlarged by slitting up the canaliculi for a short distance only, and the duct must then be examined for any obstruction. One way of doing this is to syringe some water through the punctum into the lacrymal sac and duct, when, if the duct is normal, the fluid will pass readily into the nose and down into the pharynx. Obstruction in the canaliculi is shown by the difficulty experienced in passing the nozzle of the syringe through them; obstruction in the duct is indicated by the difficulty in getting fluid to pass out of the syringe, or by noticing the fluid return through the upper punctum, and by the patient's statement that none is passing down the pharynx.

Another useful way of testing the patency of the duct

is to place a drop of fluorescein in the conjunctival sac and ask the patient to blow his nose, when, if there is no obstruction, a stain will be seen on the handkerchief.

A lash is sometimes found projecting from the punctum, and this often explains the presence of a localized inflammation of the ocular conjunctiva ; it must be looked for with the magnifying lens, as it is otherwise difficult to see.

The **caruncle** is sometimes inflamed and irritated by the presence of foreign bodies or lashes sticking on the surface.

Examination of the palpebral conjunctiva has already been described, and it need only be added that by eversion of the lids, granulations and follicular enlargement can be detected. Granulations indicate the presence of trachoma, and are found in every part of the palpebral conjunctiva, but follicular enlargement is limited to the fornices.

The **ocular conjunctiva** must be examined for local or general injection, and also for subconjunctival ecchymosis. Several innocent growths are met with in the ocular conjunctiva, such as pinguicula, pterygium, and cysts (simple lymphatic, or dermoid).

A pinguicula is a yellowish elevation growing on the inner or the outer side of the globe in the horizontal plane where the eyeball is exposed between the upper and lower lids in the palpebral aperture ; a pterygium is a fold of thickened conjunctiva found in the same situation ; lymphatic cysts may be present in any part of the ocular conjunctiva, and a dermoid cyst, which is a pearly-white flattened outgrowth, very like a piece of skin, with complete absence of any inflammatory signs around it, is usually situated on the outer side of the globe near the limbus.

General or localized œdema of the ocular conjunctiva (chemosis) occurs in certain cases, and is made apparent by pressing the lower lid up against the eyeball, when the jelly-like appearance of the mucous membrane is rendered

more obvious. If general, it is an important sign, e.g. in gonorrhœal conjunctivitis and in orbital conditions.

When general inflammation of the conjunctiva is present, the individual vessels, so plainly visible in a normal conjunctiva, are obliterated by a slight swelling of the whole membrane, and the discharge and other signs confirm the diagnosis. The ocular conjunctiva is never so much swollen in acute conjunctivitis, but the vessels are very fully dilated, with here and there some conjunctival hæmorrhages.

The sclerotic.—Affections of the sclerotic are manifested in the form of localized inflammation, nodules, etc., in various parts, though generally near the limbus. The vascularity in these cases is characteristic, and of a purplish hue, and the conjunctiva can be moved about over it without altering the intensity of the congestion, which indicates that it goes deep. Thus it is distinguished from purely surface conjunctival affections of a similar nature, such as phlyctenular conjunctivitis. The nodules are usually very tender to pressure. Thinning of the sclera in any part, generally at the equator, shows as a dark-coloured prominence owing to the pigmented choroid visible through the attenuated sclerotic ; it is a sign of longstanding pressure on the sclerotic which this structure is unable to resist. It is found in old glaucomatous eyes.

Ciliary, or circumcorneal, injection, a ring of dilated vessels surrounding the limbus, is one of the most important signs in ocular diseases (Plate 4, Fig. 2, facing p. 88). Its presence must never be overlooked, and the practitioner must learn to recognize it even though it be combined with inflammation of the conjunctiva or sclera. It is caused by the dilatation of the deep ciliary vessels surrounding the limbus, and points to an inflammation of the cornea, the iris, or the ciliary body, or possibly of all three. When it accompanies inflammation of the conjunctiva, a small relatively white area will generally

be found on the globe between the conjunctival injection and that produced by inflammation of the deeper parts.

The cornea.—There are three ways of investigating the condition of the cornea, and all of them must be employed in every case, since it is of the utmost importance not to overlook an ulcer or inflammation of the cornea, however slight.

(1) Let the patient stand facing a window and the surgeon opposite him with his back to the window. A reflection of the window will be seen on the cornea. Move the finger in different directions in front of the eye and ask the patient to follow the movements; the image of the window will now appear dull over any part of the cornea where there is an ulceration or infiltration. This is known as loss of brilliancy.

(2) Instil a drop of 2-per-cent. solution of fluorescein into the eye, and wash out with a little warm water afterwards; any ulceration or corneal abrasion will be stained a green colour. If the epithelium is intact, there will be no staining, and this proves that whatever inflammation is present is situated in the deeper layers of the cornea.

(3) Examine the cornea with the corneal magnifying lens under oblique illumination, when many additional signs may be discovered. This method should always be used, even after instilling fluorescein, as some of the smaller ulcers are not revealed except under high magnification. In this way are seen various spots, lines, and blood-vessels, all of which are important in forming a diagnosis. Superficial spots are usually ill-defined and are likely to stain with fluorescein; keratitic precipitates (keratitis punctata, "K.P.") are round discrete spots situated on the back of the cornea, and are a sign of cyclitis.

Foreign bodies are most easily discovered with the corneal magnifying lens, but an indication of their presence is a slight vascularity at the limbus in the neighbourhood and a contracted pupil on the affected side.

When the cornea is examined for the first time, and especially if there is much difficulty in separating the lids owing to blepharospasm, wire retractors should be employed—a method far safer than that of using the fingers, as much damage may be done by rough handling.

Most ulcers are accompanied by photophobia, but hypopyon ulcers are often painless at the time the patient comes for examination. In this case, the hypopyon must be definitely looked for by pulling down the lower lid, which is apt to hide the lower part of the angle of the anterior chamber. Hypopyon ulcers generally start in the centre of the cornea; therefore I would say that when a slightly raised, fluffy-looking ulcer is seen in the centre of the cornea, which is painless, examine for hypopyon.

A ground-glass appearance of the cornea, with no staining, indicates inflammation of the deeper layers, e.g. interstitial keratitis.

The iris.—If once the general practitioner can manage to grasp the various methods connected with the examination of the iris, he will have a valuable guide to the diagnosis of many otherwise puzzling cases in ophthalmology. Moreover, the iris is a part of the eye easily visible and capable of investigation without the aid of special instruments.

(1) The **reaction of the pupils to light and accommodation** should be taken in every case, and tested separately in each eye. Normally each eye should act both directly and consensually, and also to accommodation.

The eye not under examination should be completely covered, in order to exclude all light; the direct action of the eye that is uncovered can then be tested by alternately covering and exposing it. A brisk contraction ought to take place whenever light is admitted, thus showing the direct action to be normal; then, by uncovering the opposite eye, a further slight contraction ought to occur, showing a normal consensual reaction. Next, try the

action of accommodation by getting the patient first to look away in the distance and then at a near object.

If these tests are properly carried out, there are five abnormalities in the pupillary reaction to be noted:

(*a*) *No direct action*, but only consensual; indicating defective light-conducting mechanism in the eye under examination, in some part of the sensory tract, viz. in the retina or the optic nerve.

(*b*) *No reaction consensually*, but only directly. This indicates defective light-conduction in the opposite eye.

(*c*) *Neither direct nor consensual reaction.* Unless the pupil is mechanically prevented from acting by iritic adhesions, which can easily be proved by examination with the magnifying lens, because in this case they would be thick and large, this represents the fixed dilated pupil seen in glaucoma and after the use of mydriatics, and shows that there is third-nerve paralysis on the side under examination, or that the light-conducting elements on both sides are defective.

(*d*) *The Argyll-Robertson pupil*, viz. reaction to accommodation but not to light.

(*e*) *Failure of the iris to maintain contraction*, when light is focused on the eye by oblique illumination. After a few oscillatory movements of the iris, which are normal, the pupil should remain in a state of contraction. If it does not, but tends to become dilated in spite of the continued presence of light, commencing defects in the light-conducting elements of the eye under examination are indicated. This is often a warning of the onset or existence of optic atrophy, retrobulbar neuritis, glaucoma, degeneration or detachment of the retina, etc.

(2) **Inequality of the size of the pupils** is of extreme importance, since it must always be regarded as due to pathological rather than congenital causes until the former have been excluded by a careful examination. It is sometimes a matter of difficulty to decide at first whether the

larger or the smaller pupil belongs to the affected eye, and this point can only be definitely settled by reference to their reaction (*see* above). Speaking generally, dilatation means either paralysis of the third nerve, defect in the retina or optic nerve, or irritation of the cervical sympathetic, while contraction points to adhesions of the iris to the anterior capsule of the lens, paralysis of the sympathetic, or irritation of the third nerve. A contracted pupil acting well to light on one side only, with some redness and watering, is commonly seen in cases where a foreign body is fixed on the cornea, or in corneal abrasions, and is often a helpful sign when the foreign body is small or the abrasion is difficult to see. Inequality of the pupils may be the first sign of optic atrophy, of degeneration and detachment of the retina, or of glaucoma.

(3) The **shape of the pupillary border** must be noted and observation made as to its regularity or position. If irregular on dilatation, the probability is that old iritic adhesions exist, tying the pupil down to the anterior capsule in certain parts of its circumference. A pear-shaped pupil is often an indication of a tendency to or the existence of glaucoma. An oval pupil with a sharp angular point at one end indicates adhesion at this spot to the cornea, due to either recent or old perforation.

(4) The **colour of the iris** as compared with that of the other eye is to be regarded in the same way as inequality in the size of the pupils—that is to say, it is more likely to be pathological than congenital. The iris may be discoloured and muddy, with loss of pattern, as in acute iritis, or without loss of pattern one iris may be a much lighter colour than the other, showing that absorption of the stroma pigment has taken place—a common sequel of irido-cyclitis.

A semitranslucent appearance of the iris often accompanies glioma of the retina or choroidal inflammatory deposits which are tending to break down in the interior

of the eye. A greenish-coloured iris is sometimes seen in injured eyes when sympathetic inflammation is about to develop.

(5) The **actual size of the pupil,** even though the same in both eyes, is important, since glaucoma may be present if both pupils are dilated, while a small pupil in each eye is frequently seen in old people and is physiological.

(6) **Gaps in the iris** are usually congenital, but may be due to atrophy of the iris tissue after longstanding inflammation, while in syphilitic and tuberculous iritis occasionally definite *nodules* appear on the anterior surface of the iris.

(7) The **depth of the anterior chamber,** i.e. the relation of the plane of the iris to the back of the cornea, must be noted. A shallow anterior chamber is commonly seen in glaucoma, especially in the acute form, and it may be physiological in old people. A deep anterior chamber indicates probable myopia, old cyclitis with development of fibrous tissue behind the lens, dislocation or absence of the lens ; in the latter the iris is also tremulous, a sign which is demonstrated by moving the eye in different directions. The chamber may be shallow at the circumference and deep in the centre, a condition known as iris bombé, i.e. the whole of the pupillary border of the iris is bound down to the anterior capsule of the lens, and thus the fluid which is secreted by the ciliary body is prevented from circulating through into the anterior chamber, and the iris is bulged forwards at the periphery.

The anterior chamber may be obliterated altogether ; and in this case either the iris is plastered over the whole of the back of the cornea, as occurs in advanced cases of hypopyon ulcer, or the aqueous is escaping externally as a result of a penetrating wound of the cornea.

The lens.—No trustworthy opinion can be expressed as to the presence or absence of a cataract until three methods of examination have been carried out. These

are (1) by oblique illumination, (2) by reflected light in the dark room, and (3) by the direct method of ophthalmoscopy with a + 12 D lens behind the sight-hole.

The first method is only of relative value, since many lenses in old people show a marked grey reflex which may be mistaken for a cataract, though it is due merely to reflection of light from the sclerosed nucleus. If a snow-white reflex is seen behind the iris, filling up the whole of the pupillary area, it is probably a mature cataract, but even so it is best to confirm the diagnosis by the other two methods of examination.

The second method is to dilate the pupil with homatropine, unless there is some contraindication, and take the patient into the dark room and examine the eye by reflected light. For this purpose, let him be seated on a chair with the lamp placed in the position for ophthalmoscopic examination, viz. on the right or on the left side of the head just on a level with the occiput behind, a few inches away from it, and as high as the level of the ear. Then hold up the ophthalmoscope with the concave or plane mirror facing the light close to the observer's eye (right or left according to the eye to be examined), the opening in the rotating disc of lenses which has no glass in it being placed in position behind the sight-hole; and reflect the light into the eye from a distance of about two metres. In a normal eye the whole of the pupillary area will be illuminated red, owing to the reflex from the fundus (p. 19); but in cases of cataract the opacities in the lens will show up as black lines or spots in the red reflex; and if no red reflex is seen at all, the whole of the lens is opaque.

The third method is to examine the eye in the manner described under Direct Ophthalmoscopy (p. 22). Rotate the small concave tilted mirror into position, and place the eye behind the sight-hole, in front of which is placed the + 12 D lens on the ophthalmoscope. The opacities in the lens can then be examined in detail.

The lens may be dislocated owing to rupture of the suspensory ligament, following an accident. The iris will be tremulous when the eye is moved, owing to the loss of the natural support, and the anterior chamber will be deep.

The **vitreous** must be examined for opacities, which may seriously interfere with vision if they assume any size. In looking for these opacities the same methods are used as when investigating for the presence of cataract, except that oblique illumination never reveals anything in these cases unless objects are situated in the extreme anterior part of the vitreous chamber, e.g. growths. When opacities are very small and only dust-like, the best way to observe them is to use the plane mirror and dull illumination. Opacities in the vitreous usually float about when the eye is moved, and this can be observed by asking the patient to rotate the eyes up and down and from side to side while the light is still kept fixed on the pupillary area ; when the eye comes to a standstill the opacities will be seen to float across the red reflex.

In cases of large hæmorrhages into the vitreous the eyeball is so full of blood that no red reflex can be seen at all. In these circumstances the practitioner may be in doubt whether he has a mature cataract to deal with or not, but if a cataract is so dense that the whole of the red reflex is shut out from view, it would be plainly and obviously visible by oblique illumination, while the vitreous opacity is invisible by this method.

Hæmorrhage into the vitreous may be mistaken for intraocular new growth, but this almost invariably originates from the choroid, and, the retina being involved, the projection of light is bad, while in hæmorrhage it is good all over.

Some opacities are so small that no method of illumination will locate them. They are probably of little importance.

2. Examination for Diseases with no External Evidence

In cases where patients complain of defective sight in one or both eyes but external signs of disease are absent, the cause may be an error of refraction, or some intraocular disease, or both, and the investigation must be carried out systematically in the following way.

In the first place, we must verify the patient's statement regarding his vision by **taking a record of the sight in each eye separately** with Snellen's distance types, and **record the vision.** If the largest letter cannot be read, the patient must approach the board until a distance is reached at which he is able to read the top letter; this distance may be three metres, two, or one, and the vision is recorded as $\frac{3}{60}$, $\frac{2}{60}$, or $\frac{1}{60}$, as the case may be. If he is unable to see any letter at any distance, the fingers must be held up about two metres away from the face and the patient asked to count them; if this is impossible, however near the eye the fingers are held, the hand must be moved in front of the eye, and if the movement is seen the vision is recorded as "hand movements." Should the sight be so bad that the patient is unable even to see this, he must be taken into the dark room and light thrown into the eye from an ophthalmoscopic mirror. If he can perceive the light, his vision is recorded as perception of light ("P.L."), but if not, he has no perception of light ("No P.L.").

The **pupil reaction** is then examined as described above, and is noted.

The **tension of the eye** must be taken. The intraocular pressure can be recorded in terms of millimetres of mercury, but for this purpose special instruments are used which require experience and technique not generally possessed by the general practitioner, and moreover the eye must

be under cocaine. As this is seldom possible in the routine of private practice, the tactile sensation with the fingers must be cultivated, and relied upon as much as possible. Since all eyes vary within physiological limits, the practitioner should never lose an opportunity of feeling the tension and comparing one eye with the other. The proper way to feel tension is to direct the patient to look down towards the ground, then place the forefingers of the two hands close together on the eyeball, pressing slightly backwards into the orbit between the orbital margin and the globe ; next press downwards and feel the pressure in the same way as one would feel for fluctuation in an abscess, and compare the two sides. It is well to get into the habit of feeling the tension of the eye in any condition.

The next step is to carry out **retinoscopy,** since we must assume that the defect of vision is due to a refractive error until we have proved the contrary. This can be done with or without a mydriatic, but in many cases, especially when the vision cannot be brought up to $\frac{6}{6}$ with any glass applied subjectively, a mydriatic is desirable. The promiscuous use of atropine or homatropine for diagnostic purposes in all affections of the eye is not to be encouraged, but one soon learns in what circumstances to withhold it, and in the majority of cases it is perfectly safe (*see* p. 39).

By comparing the results of our retinoscopy with subjective testing, the approximate correcting glass can be found and any improvement in vision recorded. If the improvement is considerable, it is probably safe to assume that the case is one of refractive error alone ; the visual defect is cured by wearing suitable glasses, the symptoms are relieved, and there is nothing more to be done. I am strongly of opinion, however, that detailed refraction work cannot form part of a busy general practitioner's routine, since it involves too much expenditure of time and trouble without any compensatory advantages ; and

when he has once decided that glasses are necessary it will be wiser for him to hand the case over to someone experienced in this branch of ophthalmology.

If refractive error is absent, or if correcting glasses fail to produce any amelioration in the vision, the case is probably one of intraocular disease, which may be situated in any of the media—the retina, the optic nerve, or the choroid.

We must therefore next proceed to examine the **fundus,** and this must be carried out in a darkened room by means of **ophthalmoscopy.**

I have stated elsewhere that, in addition to refraction work, all detailed ophthalmoscopic examination is practically impossible for the general practitioner, and my reason is that there are three main difficulties to be overcome. The first is, to get beyond and learn to disregard all the various reflections from the mirrors, cornea, etc., and obtain a view of the interior of the eye ; the second, when the different parts of the fundus become visible, to distinguish the normal from the abnormal ; the third, having definitely decided that a condition is abnormal, to interpret pathologically what is seen. From my own experience, I hold it to be impossible, with the material at his disposal, for the general practitioner satisfactorily to master these three difficulties unless he has had a year or two's special training before entering general practice.

At the same time, he can make very effective use of his ophthalmoscope, and in order to assist him I will describe the various methods in detail. Of these there are three, and he will probably elect to stop short at the first.

(1) **The observation of the red reflex** (Plate 5, Fig.1, facing p. 122). In speaking of opacities in the media (p. 15) I referred to this reflex as being visible when light is reflected into the eye from an ophthalmoscopic mirror. It should be visible, provided the media are clear, with the same uniform intensity to whatever part of the fundus the light is directed. The different parts can be examined either

by inclining the head, and thus projecting the light towards any particular area we wish to investigate, or by asking the patient to move his eye into the desired positions.

If, for example, one observes in any part of the fundus a white, grey, yellow, or black reflex instead of the usual red colour, one knows that there is something abnormal in the interior of the eyeball—perhaps some inflammatory deposit in the choroid or vitreous, old choroidal scars, or detachment of the retina ; it does not matter for the moment exactly what the nature of the condition is. The detail may require considerable experience in ophthalmoscopic diagnosis, and to apply a name to any particular disease and satisfy the patient's mind respecting it may be a matter of extreme difficulty, quite beyond the general practitioner's reach ; but he has been able to locate the affection as intraocular, and is prepared to advise regarding a further opinion, which is a point of no small importance.

(2) The next method of using the ophthalmoscope is that of **indirect examination** (Fig. 1) ; the right eye being usually examined first.

The patient must be seated on a chair with the lamp a little distance away from the right side of the head at a height level with the ear, and horizontally on a level with the back of the head. The surgeon, sitting exactly opposite the patient, holds the ophthalmoscope up to his right eye with his right hand in such a manner that he is able to elevate the little finger ; a lens of + 2 D is rotated up behind the sight-hole, light is reflected into the eye from the large concave mirror, and the patient is told to keep his eye fixed on the little finger. This position ensures that the disc of the eye to be examined is exactly opposite the sight-hole in the ophthalmoscope. Now, in order to bring the details of the fundus into focus, the large + 13 D lens is held in the left hand, placed in front of the patient's eye, and drawn slowly backwards and forwards, possibly also from side to side, until a sharp

image of the disc becomes visible. It is to be remembered that no movement whatever must take place on the part of the patient or surgeon when once the position described above is taken up, with the exception of the left hand holding the lens ; and also that, unless a red reflex is obtained before the details of the fundus come into view, either the light is not on the eye or the surgeon's eye is not opposite the sight-hole. The indirect method of examination is most useful for getting a general idea of the

Fig. 1.—Indirect ophthalmoscopic examination.

condition of the fundus, also in cases where any of the media are hazy, and in cases of high myopia ; the direct method is not suitable in these circumstances, and may be even impossible.

The examination of the left eye is conducted in the same way, only substituting left for right in the description given above ; but if the surgeon prefers not to change his ophthalmoscope to the left hand he may direct the patient to look at his left ear when the disc of the left eye is in a line with the sight-hole.

(3) **Direct examination** (Fig. 2) is carried out in the following way. Let the patient be seated and the light arranged as for the indirect method; stand on the right side of the patient, rotate the small inclined concave mirror into position opposite the sight-hole by holding the ophthalmoscope in the hand, mirrors upwards, and rotating the mirror so that it inclines towards the right if the right eye is to be examined, and towards the left if the left eye is to be examined; use the right eye for the patient's

Fig. 2.—Direct ophthalmoscopic examination.

right eye, and the left eye for the patient's left eye, and also in the latter case stand on the left side of the patient with the lamp arranged in a similar manner as for examination of the right. The patient's accommodation must be relaxed as well as that of the surgeon; the former by directing him to look straight in front, or by putting him under a mydriatic; errors of refraction in both patient and surgeon must be corrected by means of the lenses on the rotating disc of the ophthalmoscope. Hold the ophthalmoscope exactly vertical in position about $1\frac{1}{2}-2$ in.

in front of the patient's eye and bring the eye down to the sight-hole by bending over; then, by moving the head together with the ophthalmoscope slowly backwards and forwards, the disc comes into view. If only some vessels are seen to begin with, trace these vessels up to a point where many more vessels become visible; you must then be near the disc.

Details of the fundus can now be examined in the following order, viz. disc and vessels, macula, the rest of the fundus.

The same principles apply regarding the red reflex as in the indirect method.

It may be necessary, after taking up the position described, to rotate the mirror *very slightly* in one way or another to get the incidence of the light exactly right, and to be careful that there are no obstructions of any kind interfering with the passage of the light from the lamp to the mirror.

The direct method is applicable when it is desired to examine the condition of the fundus in more detail, as the magnification is greater, and it is the only way of estimating the degree of projection forwards in cases of growth, or the extent to which the retina is detached, or the amount of swelling of the disc in optic neuritis.

Even after carefully following out these methods of examination, one may still be unable to find any changes to account for the defective vision. Such cases may be due to tobacco poisoning, or some other form of toxic amblyopia, or to retrobulbar neuritis, etc. It is then necessary to resort to the examination of the **field of vision** by means of one of the various forms of perimeter or scotometer. The general practitioner may not have these instruments in his possession, but he can get a very good idea of the field of vision by testing it with a small white 10-mm. square of white paper mounted on some suitable holder, preferably all black.

There is a general contraction of the field of vision in optic atrophy, contraction on the nasal side (or occasionally some other part) in early glaucoma, central defect in retrobulbar neuritis, and loss of field over the affected area in detachment of the retina. Never neglect the history of slight blurring of the sight, however transitory in nature, or of flashes of light and similar subjective phenomena, especially in myopia, and remember that a suggestive history in toxic amblyopia of any kind is that the vision in both eyes has failed for distance as well as for reading in a comparatively short space of time.

Lastly, one has to examine the fundus as far as possible in those cases where defect of vision is due to some opacity in one of the media, or because the iris with the pupil has been drawn up out of position, so that there is no longer any pupillary aperture through which a view of the fundus can be obtained. In these circumstances neither the direct nor the indirect method can be used; and yet it is necessary to gain some idea of the condition of the fundus, especially the retina.

The **projection of light** must therefore be tested. No normal structure of the eye, not even the sclerotic, nor any opacity resulting from disease, can altogether exclude light from the interior of the eye, and a response can always be obtained from the retina, provided it be healthy. Therefore, while the patient is seated in the dark room with his back to the lamp, reflect light into the eye from an ophthalmoscope in various directions, and at the same time ask him to indicate, by pointing with his finger, from what part of the field of vision the light appears to come. When he is able to project it accurately, that part of the retina is healthy, but when he is unable to do so, some particular part is functionless. When no light is perceived in any part of the visual field, there is "no perception of light," and the eye is, in every sense of the word, blind.

CHAPTER II

URGENT CASES IN GENERAL PRACTICE

Some conditions of the eye are considered by patients as extremely urgent when in reality they are not of serious importance ; others are regarded very lightly by the patient although the general practitioner knows them to be fraught with disastrous consequences so far as the ultimate effect on the eye and vision is concerned ; and there are yet other cases that are urgent to patient and practitioner alike.

The general practitioner must be prepared to treat them all as equally urgent, and a very careful investigation should always be made, according to the methods of examination already described. If the case prove in the end to be only trivial, the patient's anxiety is relieved, while the advantage of forming an early diagnosis in any condition that is serious, or likely to become so, cannot be too often insisted upon.

An opinion expressed, often hastily, by a practitioner in such circumstances will make a lasting impression, and therefore it is that sound judgment is so necessary in all these cases.

A **painful eye** leads the patient to hurry off to his medical man at once. As he nearly always considers that the pain is the precursor of ultimate loss of sight, he becomes alarmed, and no doubt thereby the pain is considerably exaggerated.

He may describe it as a pricking, a smarting, an aching or a throbbing, or a " drawing " feeling behind the eyes. It may be worse at certain times, e.g. after reading, or during the night, or it may last all day and all night independently of the use of the eyes.

Pricking and smarting pain is more likely to be superficial, e.g. ulceration of the cornea or abrasions; aching pain may mean iritis or glaucoma, and pain " at the back of the eyes " is probably due to some error of refraction which is causing eyestrain.

Speaking generally, with the exception of iritis and glaucoma, the severity of the pain is in inverse proportion to the seriousness of the condition.

The pain may be accompanied by **redness of the globe,** either general or localized. General vascularity may affect both the palpebral and the ocular conjunctiva, while localized redness may occur only round the sclero-corneal margin, when it is known as ciliary injection, the importance of which can never be over-estimated (*see* p. 9). Redness may be localized to one part of the globe, as in episcleritis, when the affected area is painful and tender to the touch, or to the inner or nasal side, when a hair projecting from the punctum may be found scratching the ocular conjunctiva at this spot, causing intense irritation.

Foreign bodies under the upper lid and abrasions of the cornea cause severe smarting pain and dilatation of all the palpebral and ocular conjunctival vessels, producing a general redness and much watery secretion. A careful search must be made, everting the upper lid, and staining with fluorescein, when any abrasions will at once become apparent. In the same way small superficial ulcerations of the cornea are seen which might otherwise easily escape observation.

When ciliary injection alone is present and accompanied by pain, while the rest of the eye and the conjunctiva are clear, the case may be one of iritis. This is verified by noticing any discoloration of the iris, a fixed contracted pupil, and perhaps some adhesions to the anterior capsule of the lens observed only with the magnifying lens. The pain of iritis is generally worse at night.

A red painful eye is also seen in glaucoma, though the redness in this case is not so intense as in inflammatory cases, and is of a duller hue. It is due to obstruction to the circulation caused by the intraocular pressure, and the diagnosis can be established by feeling the tension and comparing it with that of the other eye. The other distinctive signs of glaucoma will also be present, viz. fixed dilated pupil, steamy cornea, shallow anterior chamber, etc. For the moment it does not matter whether the glaucoma is primary or secondary, as in any case the practitioner will be well advised to call in a further opinion.

Pain accompanied by **photophobia** almost certainly points to superficial ulceration of the cornea, generally found in phlyctenular conditions and in superficial epithelial ulcers, when there is almost always some redness as well ; but exaggerated photophobia is most commonly seen in children ; and the pain does not necessarily bear any relation to the severity of the ulceration. Often intense photophobia remains after all the ulcers have healed. To make sure whether this is the case, separate the lids with retractors and stain with fluorescein.

A painful eye may be unaccompanied by vascular injection of any kind. Patients often complain of the most agonizing pain in one eye, extending round the temple and over the forehead, which, however, looks perfectly normal ; in such cases the thoughts of the general practitioner frequently turn towards glaucoma as the condition most likely to be associated with such severe pain.

If the pain is really as acute as it is said to be, the only form of glaucoma which could possibly account for it would be acute glaucoma, since the other forms are painless ; in these circumstances the symptoms are characteristic—dilated pupil, increased tension, steamy cornea, shallow anterior chamber, some vascular injection, and seriously lowered visual acuity, often only hand movements being seen. Acute glaucoma never goes with a briskly acting

pupil, brilliant cornea, normal tension, normal depth of the anterior chamber, and a white eye. If these are present, the practitioner may feel quite safe in expressing a confident opinion against glaucoma. Moreover, in many of these cases, in spite of the apparent severity of the pain, sleep at night is not disturbed, which is contrary to all experience in cases of acute glaucoma.

Pain in eyes which show no external evidence of disease is probably due to eyestrain from some error of refraction, an error which is usually shared between the two eyes. Or the pain may have nothing whatever to do with the eye, but may be "neuralgic" in character, the seat of it being behind the eye or along the supraorbital nerve.

A **red eye** is always a source of anxiety to the patient, especially when it shows no sign of clearing up after a few days; and it is well to remember that a red eye confined to one side for more than a few days or a week is sure to be something more than an ordinary simple conjunctivitis.

If **unaccompanied by pain** it may be conjunctivitis. The vascular injection may be general, over the ocular as well as the palpebral conjunctiva, so that the whole eyeball is red and there is some discharge of varying quantity, accompanied by sticking of the lids during sleep.

The redness may, however, be localized either to the outer and inner canthi and along the edge of the lids, as in angular conjunctivitis; or to one small point on the bulbar conjunctiva, perhaps near the limbus, when it may be episcleritis; or to the nasal side of the globe near the puncta, where a lash may be found projecting from the opening and scratching the globe, though this often causes pain as well.

Subconjunctival ecchymoses occur as localized intensely red patches on the ocular conjunctiva; they never give rise to any pain, and are of no practical importance except that they may be a warning of increased arterial tension

and high blood-pressure, suggesting an investigation of the general vascular condition. The redness may be confined to the limbus, when it is known as ciliary injection, the importance of which has already been sufficiently emphasized. This occurs in cyclitis of all kinds, and although the ciliary injection associated with iritis or corneal inflammation is seldom present without pain, that of cyclitis very often is. A careful search should therefore be made with the corneal magnifying lens to see if there are any signs of keratitic precipitates, the one infallible proof of cyclitis.

We have now to consider **sudden loss of sight in one or both eyes,** more commonly the former. If the history is absolutely genuine, there are only a few conditions which can possibly account for the phenomenon. They are :

(1) Detachment of the retina.
(2) Hæmorrhage at the macula, or into the vitreous.
(3) Embolism of the central artery of the retina.
(4) Thrombosis of the central vein of the retina.
(5) Metastatic inflammatory deposit in the choroid, or the nerve head.
(6) Toxic conditions, such as quinine poisoning.

With the exception of embolism of the central artery of the retina, none of these conditions produces absolute blindness ; but the deterioration of vision is so pronounced that it cannot fail to attract the patient's attention, even though only one eye is affected.

However, it is wise never to accept a patient's history, even though it may be correct, but always to verify it by carrying out the routine examination as for cases where defects of sight are associated with no visible external signs of disease (*see* p. 17 *et seq.*). Most of the conditions mentioned can only be accurately diagnosed by direct ophthalmoscopy, a method which I have not encouraged

the general practitioner to employ. At the same time, a good deal can be learnt by making use of the " red reflex " test (*see* p. 19).

In **detachment of the retina** there will be a greyish reflex from some part of the fundus (generally the upper quadrant in an early stage, or the lower quadrant after a few weeks), instead of the normal red appearance, and if the patient is asked to set his eye in motion by looking up and down and then straight in front, the grey area can be seen to move, and sometimes the tortuous retinal vessels, showing up black against the whitish reflex, can be perceived.

In **hæmorrhage into the vitreous** no red reflex will be seen at all, and, having ascertained by other methods of examination (*see* p. 15) that the lens is not the cause, the only other transparent medium which can be affected and effectually block out the light is the vitreous. It will be found also that in these cases the retina itself is healthy, as shown by accurate projection of light, from which it follows that the cause of the obstruction is in front of it.

In **inflammatory deposits in the choroid** a white, hazy, ill-defined patch will be seen in some part of the fundus instead of the normal red reflex.

The remaining causes of sudden loss of sight can only be determined by careful search with the ophthalmoscope ; if he sees them, the practitioner will be wise to take an expert opinion.

There are certain defects of sight which have obviously not come on suddenly, but have only been **noticed suddenly** from the patient's attention having been drawn to them by accident. This is commonly the case in monocular cataract, and in amblyopia resulting from neglected or untreated squint, when the eye has become straight owing to the readjustment of the muscle-balance in after life. The former can be verified easily by the methods of examination already described (*see* Examination of the Lens,

p. 14), and the latter by the history and by the fact that the fundus appears perfectly normal.

Accidents are always urgent from the patient's standpoint, and should be regarded as such by the general practitioner. I have devoted a special chapter to injuries to the eye (p. 109 *et seq.*), but the subject must be touched upon here.

The damage to an eye from gunshot wounds, perforating injuries, blows, may be either immediate or remote, and an injured eye must be examined as carefully as possible at the time of the injury, and still more thoroughly later on when the parts concerned can be studied more in detail.

Apart from abrasions and foreign bodies, which are comparatively simple to diagnose and deal with, the most important point to determine as soon as possible is whether the eyeball has been opened as a result of **a punctured wound or a rupture**. In these cases the aqueous will already have been discharged, and therefore the anterior chamber will be shallow or possibly obliterated altogether, so that the iris is pushed forwards against the back of the cornea, while some iritic tissue may possibly be protruding through the wound, and thus an oval-shaped, drawn-up pupil will be noticeable. The tension will also be very low, though it is not advisable to feel it, in case more of the iris should be pushed out ; the tension, however, may be lower than normal, even after a blow on the eye with a blunt instrument, without penetration of the cornea.

When the eyeball ruptures as a result of a blow, the opening occurs in the sclera just behind the limbus ; therefore look carefully all round the globe in this region to see if there is any swelling under the conjunctiva, or any dark or black area, showing that the ciliary body or part of the choroid is projecting through the lips of the scleral wound.

A wound either in the cornea or in the sclera may be completely blocked by the protruding iris or ciliary body ; or the wound may be so extensive that the eyeball is

obviously quite soft and collapsed, and, moreover, while the eye is being examined such a wound may gape from the pressure behind it, and the lens has been known to escape. It is therefore most undesirable as well as unnecessary to make an exhaustive examination when the case is first seen ; frequently there is such a copious extravasation of blood into the anterior chamber that the iris is scarcely visible at all, and the relationship of the different parts cannot possibly be made out, so that nothing is gained by exposing the eye for a long time in the hope of discovering something, while a good deal of harm may result. It is impossible to discover the extent of the damage until the hæmorrhage has been absorbed, which occurs in a comparatively short time, and until a more complete examination can be made the practitioner will do well to suspend his judgment and be cautious in any opinion he may express. In the meantime, instil atropine and tie up the eye with a firm pad and bandage. Wounds in the eyeball cannot be sewn up ; any manipulation of this nature is dangerous, and the best method of keeping the lips of the wound in apposition is by means of the closed lids.

Prolapsed iris *through a small wound* must be dealt with at once, as explained in the chapter on Operations (p. 46) ; but the larger wounds must be allowed to heal up, at any rate partially, before any operative procedures are attempted. A certain amount of risk must be accepted for a day or two, e.g. sepsis and adhesions of the iris to the cornea ; but this is far less than the risk of keeping the eye open for any length of time for examination or for washing out. Injury to the deeper parts, with or without perforation, may occur which can only be verified after a certain lapse of time, e.g. traumatic mydriasis, injury of the lens, vitreous hæmorrhage, rupture of the choroid, detachment of the retina, commotio retinæ. These injuries will be described later on (p. 114) ; a

most careful examination of all parts of the eyeball must be conducted on the lines indicated in Chapter I. No hasty opinion should ever be given, and in any doubtful or specially serious case further advice should be sought.

Diplopia can easily be verified by placing a red glass in front of the right eye and a green glass in front of the left ; then, by moving a lighted candle through the different parts of the field of vision, two separate images of the candle will be seen in certain positions, a red and a green one. This generally points to paralysis of one or more muscles, though it is not necessary for the general practitioner to localize the muscle or muscles affected or the part of the nervous system involved ; but the fact that diplopia is present should lead him to advise the patient to consult an ophthalmic surgeon or a neurologist.

There still remain certain cases which the practitioner must always regard as urgent, although the patient is very slow to realize that they are important, or at any rate that there is any need for immediate treatment. The reasons for this I shall mention under each heading.

Squint.—The earlier a squint is treated the better the results, for unless it is taken in hand at once there is danger that the sight of the squinting eye may be lost and may never be recovered. I shall return to this subject later.

Hypopyon ulcer.—This is one of the most serious forms of ulceration of the cornea, and is liable to cause rapid destruction of tissue, leading to the loss of the eye in a few days, unless appropriate treatment (*see* p. 81) is applied immediately. The reason why the patient recognizes no urgency is that, owing to rapid destruction of the corneal nerve-endings, he feels very little pain and does not suppose that the eye is in danger.

Glaucoma has already been touched upon in this chapter (p. 27), and all practitioners appreciate the urgency of the condition, although the patient frequently fails

to do so, in spite of the severe pain or the gradual deterioration of vision. Owing to the highly strung temperament of glaucoma patients, they are apt to hesitate in accepting advice, and the delay thus caused is often sufficient to produce irreparable damage to the sight.

Nor must it be forgotten that acute glaucoma is liable to be mistaken for a bilious attack, the symptoms being very similar. It is advisable, therefore, in all cases of headache and vomiting to examine the eyes in order to exclude the presence of increased tension of the eyeball.

Iritis, again, is an urgent affection—as urgent, indeed, as glaucoma, and patients are more ready to appreciate the fact, owing to the excessive pain they suffer. The chief aim of the general practitioner must be to produce full dilatation of the pupil by getting the eye under atropine as early as possible; this is the basis of all successful treatment.

Cyclitis, too, is an extremely urgent condition (*see* p. 93), but in many cases it is so insidious in its onset that the patient does not take it seriously until the sight begins to be affected. The ciliary injection which is one of the visible external signs of inflammation of the ciliary body is often very slight, and is not enough to attract the patient's attention, but the merest trace of circumcorneal injection should lead the practitioner to examine the cornea with his magnifying lens for the presence of K.P. (*see* p. 93).

Myopia.—Short sight is considered by many to be rather an advantage than a disadvantage, and because patients can read well they imagine that there is nothing really wrong, the defective distant vision being to them a matter of indifference. It is difficult to persuade them of the risk of possible progressive myopia and all the attendant fundus changes by which the sight may be endangered; they must be plainly warned, therefore, of the necessity for

taking all due precautions, especially in the early part of their life.

Vitreous opacities may be regarded by the patient as a symptom of a "liver attack," about which he need not trouble, or as a sign of approaching loss of sight. Large opacities are seen in cyclitis, myopia, choroiditis, and degeneration of and hæmorrhages into the vitreous, when the vision is usually affected, while sometimes opacities are so small that they cannot be focused by an observer and the sight is normal. The latter are possibly entoptic phenomena, and the patient may be encouraged to disregard them, while the former call for prompt treatment of the condition which gives rise to them.

All forms of **conjunctivitis** accompanied by excessive purulent discharge are urgent, since they are probably due to the action of virulent organisms and may lead to ulceration of the cornea.

Any history given by the patient of **loss of field** in any part must be regarded by the practitioner as extremely urgent, though the patient may be inclined to treat it lightly. Glaucoma and many nerve lesions have this symptom in common in their early stages.

CHAPTER III

DRUGS IN OCULAR DISEASES

Lotions.—Washing out the conjunctival sac with some form of lotion is always necessary when there is any inflammation or discharge from the conjunctiva, lids, or lacrymal passages, and also in ulceration of the cornea.

Boric acid (10 gr. to the ounce) is always a safe lotion to use, but will not be successful in all forms of inflammation of the conjunctiva. In the more virulent forms **perchloride of mercury** (1 : 7,000), or **quinine** lotion (3 gr. to the ounce) must be used. For ordinary corneal ulcers boric-acid lotion is most suitable, being the least irritating; but here again, if the ulceration is due to a virulent organism, one of the stronger lotions, or **eusol** (1 in 6), or even **peroxide of hydrogen,** is called for, even though it may produce a little smarting pain owing to its action on the exposed corneal nerve-endings.

It is doubtful whether lotions are of any value in deep inflammations of the eye, but they are often comforting to the patient, and should therefore be prescribed in addition to other remedies.

Lotions containing **zinc** (1–3 gr. to the ounce) are useful in all forms of chronic conjunctivitis and blepharitis

Silver preparations, i.e. silver nitrate ($AgNO_3$ 2 per cent.), protargol 20 per cent., and argyrol 25 per cent., should be applied by the practitioner himself, and never given to the patient to use in the form of drops at home. The painting is carried out by means of a cotton-wool swab on the end of a glass rod; no neutralizing with salt solution is necessary, but any excess of fluid should be mopped up with a cotton-wool sponge.

Acute inflammations of the conjunctiva with much purulent discharge and blepharitis require the silver-nitrate preparation, sometimes every day; the other silver preparations are weaker, and in the milder cases need be used only about once or twice a week. Too frequent application often produces conjunctival irritation, which may be difficult to distinguish from the original bactericidal inflammation, and also gives rise to argyrosis (silver staining of the conjunctiva), which remains permanently.

Atropine.—This drug is used in the form of ointment or drops in the strength of ½ or 1 per cent.; the ointment is better for children, as it is less likely to cause symptoms of atropine poisoning, and since the accommodation is very strong in children the stronger percentage should be used. Atropine is the best form of mydriatic for children in all cases, but in adults homatropine may be used for refraction, though atropine is preferable in the various forms of inflammation of the eye.

The conditions in which atropine must be employed are ulcerations and inflammations of the cornea, corneal abrasions or after removal of foreign bodies (once or twice), and inflammations of the iris and ciliary body. *There are no exceptions.* All supposed contraindications, such as age, position of the corneal ulcer, increased tension complicating corneal ulcerations, iritis, and cyclitis, have no foundation in fact, and any hesitancy in its application only allows time for complications to arise which its vigorous use would have prevented.

There are, it is true, certain conditions in which age may be a contraindication to the use of atropine, but inflammation of the cornea, iris, or ciliary body is not among them.

In the case of *corneal ulcer*, it has been suggested that in ulcers which tend to perforate there will be more liability for the iris to prolapse when the pupil is fully dilated, if the ulcer is situated away from the centre of the cornea,

and that eserine should therefore be employed in these cases. If an ulcer perforates, no matter where it is situated, the iris is almost certain to prolapse; nothing is gained, therefore, by using eserine, and much harm may be done. Eserine increases the vascularity of the parts concerned, and so aggravates the inflammatory reaction which it is our business to subdue by means of atropine.

The increased tension associated with certain types of corneal ulcer, e.g. hypopyon, and longstanding irido-cyclitis, is caused by the sticky nature of the fluid in the anterior chamber, which blocks up the channels of exit. This, however, is no excuse for withholding atropine, though in such cases it is extremely doubtful whether the drug has any influence one way or the other, and if any exception to the use of atropine can ever be justified, it is in this type of case. The increased tension is an indication that, in addition to the atropine treatment, a small opening should be made in the eye, by an incision either at the limbus (paracentesis) or through the base of the ulcer, to let out the aqueous, so that the tension may be temporarily reduced. In iritis with increased tension, where the pupil is contracted, the cause is found to be that the pupil is entirely adherent to the capsule of the lens (total posterior annular synechia), and atropine is called for more urgently than ever, in the hope, generally fulfilled, of breaking down some at least of the adhesions and thus allowing free circulation of the aqueous.

In cases of cyclitis the eye has to be kept for many weeks, perhaps months, under the influence of atropine, and it is only another common fallacy to suppose that if the pupil is kept too long dilated it will not return to its normal size when the atropine is discontinued; this leads the practitioner in some cases to stop the atropine much too early, whereas he should persevere with it for several weeks longer than appears to be absolutely necessary, so that recurrence of inflammation may be prevented

An opinion is prevalent that in obstinate posterior synechia breaking down of the adhesions is facilitated by the alternate use of atropine and eserine—a sort of concertina action, I presume. This belief is entirely without clinical foundation: the eserine, as I have said, only aggravates the inflammation and encourages the formation of more adhesions; while atropine causes a constant steady pull on all the adhesions, when the weaker ones are sure to give way, thus rendering the eye safe for the time being. After all signs of inflammation have subsided an iridectomy can be performed, and the eye made permanently safe.

Atropine and homatropine have to be frequently used *in refraction work*, and there is a prejudice in the mind of many general practitioners against the use of a mydriatic in people over forty years of age, because it is said that in patients of this age an attack of acute glaucoma may be induced. My own belief is that the danger is overrated, and certainly very few such cases have been met with even by those having long experience. It may be allowed, however, that in a case where the anterior chamber is shallow and there is a tendency at the same time towards dilatation of the pupil, even under the stimulus of light, together with a rather full tension, it is best to avoid the use of a mydriatic, if possible. The reason why a dilated pupil causes increased tension is because, in the presence of a shallow anterior chamber, there is not room enough for the folded-up iris to occupy the angle of the anterior chamber without touching the back of the cornea, and in this way the outflow of fluid is blocked at the angle. Unless it can be proved that atropine raises the tension of a normal eye—of which there is no available evidence—the use of a mydriatic is attended by no danger. It is not the mere fact that a patient has reached the age of forty that determines the advisability of withholding a mydriatic. My experience is that the fear of producing glaucoma in middle-aged and older patients leads the practitioner to

abstain from using atropine in cases where it is of paramount importance to get the pupil dilated.

The only signs, therefore, which contraindicate atropine and homatropine in patients over forty-five are a shallow anterior chamber, failure to maintain contraction of the pupil when light is thrown on to the eye and kept there, a decidedly full tension, and an iris capable of complete dilatation. Unless these four signs are present together, atropine or homatropine may be quite safely employed at any age.

When atropine is used for a long time, a sort of eczematous irritation of the skin of the lids and face is sometimes produced, together with irritative conjunctivitis. In these cases, if a mydriatic is still required, hyoscine hydrobromate drops ($\frac{1}{2}$ per cent.) must be substituted for atropine.

Eserine.—This drug is used for lowering the tension of the eye, in strengths of $\frac{1}{2}$ to 1 per cent., and is very potent as a temporary measure in acute glaucoma. It is also employed in chronic glaucoma where it is necessary for various reasons to postpone or to avoid operation; it undoubtedly keeps the symptoms in abeyance, but they are liable to recur as soon as the instillation is discontinued—which only serves to show the risk such patients run when they are thus entirely dependent upon having the drug always at hand.

Eserine, as we have seen, also increases the vascularity of the eyeball, mostly by the formation of new vessels which often can be seen passing over the surface of the cornea; it is therefore useful in indolent types of ulcers and inflammation where increased vascular supply is desirable. Sometimes, however, it produces considerable irritation in these cases if employed for too long a period.

Pilocarpine is used as a substitute for eserine locally, though it is not so effectual in inducing reduction of tension. It is also employed internally in some cases where

it is desirable to procure sweating, as in acute inflammations of the choroid, detachment of the retina, etc.

Cocaine.—This is the local anæsthetic usually employed in all operations on the eyeball and conjunctiva. It is used in strengths varying from 2 to 5 per cent.

Foreign bodies are removed, and intraocular operations and operations on the muscles are performed, under local anæsthesia with this drug. In addition to the cocaine, subconjunctival or subcutaneous injections of novocain and adrenalin (1-in-10,000 adrenalin and 2-per-cent. novocain) are useful when some particular stage of an operation is likely to be more painful than the patient can reasonably be expected to bear.

Cocaine loses its effect if the eye is very much inflamed, or if the tension is raised at the time of the operation; this is why it is advisable to perform operations under such conditions with a general anæsthetic.

Cocaine also may be instilled into an eye affected with a corneal ulcer when the blepharospasm is so intense that a proper examination of the cornea is impossible, except at the expense of rather rough handling; the temporary relief of pain renders the examination perfectly easy.

It must, however, always be remembered that in many patients cocaine has the property of loosening the corneal epithelium; and although the epithelium may quickly be renewed in eyes that are perfectly healthy, yet in inflammations of the cornea, and especially in ulcers when the corneal epithelium is already exfoliated from necrosis, cocaine if used constantly may in this way cause ulceration, and also prevent the healing process from taking place properly. Therefore, however tempting it may be to relieve pain of a superficial character, as in corneal inflammations of all kinds, abrasions, etc., cocaine should never be used in lotions or in drops for this purpose. Pain is more effectively relieved by tying up the eye with a pad and bandage, which can always be done provided there

is no attendant conjunctivitis; and even if there is, frequent washing out of the conjunctival sac, combined with tying up in the intervals, will answer the purpose almost as well.

Dionine (ethyl-morphine hydrochloride), when applied to the eye in various strengths, from 3 to 10 per cent., produces a marked lymphocytosis with œdema of the conjunctiva. It is said to relieve pain in some of the deeper inflammations of the eye, but it is more often used for stimulating an eye which is quieting down too soon, before inflammatory products have been completely absorbed. It is therefore used in irido-cyclitis, corneal nebulæ, etc.

Dionine also appears to have the property of consolidating the epithelium after the healing of corneal ulcers, especially of the superficial type; it has therefore been used for several months at a time, once every day, to prevent the recurrence of stellate and dendritic ulcers.

Yellow oxide of mercury ointment. — The many and various ocular conditions for which yellow oxide of mercury has been prescribed by general practitioners have, I confess, often surprised me. It is used for all kinds of inflammation, acute as well as chronic, superficial as well as deep; and it almost seems as if the principle governing its application is, "When in doubt give yellow oxide of mercury." This may be largely the fault of the textbooks, which do not sufficiently explain its action, but in any case the fact remains that it is given rather promiscuously.

The action of yellow oxide is definitely stimulating, possibly irritating, and vascularity is produced or increased. Its use should therefore be restricted to cases which have entered the chronic stage too quickly and need stimulating because inflammatory products have not been satisfactorily absorbed. It should certainly not be employed in acute conditions, nor in ulcers of the cornea, and yet I have known it often prescribed for phlyctenular

ulcers because it sometimes does good in phlyctenular conjunctivitis, which is quite a different thing.

I have frequently seen conditions where the signs and symptoms have been intensely aggravated by its use, and where immediate improvement has followed its discontinuance.

It is sometimes very useful as a counter-irritant, e.g. in cases of obstinate blepharospasm, which sometimes persists long after all signs of inflammation of the cornea have completely disappeared.

It is also suitable in chronic sluggish inflammations of the lids and cornea, and to assist in the absorption of nebulæ; in fact, in any kind of corneal inflammation for which dionine is advisable.

In applying yellow oxide of mercury to inflamed lids, i.e. blepharitis, it should be definitely rubbed in, the massage being especially called for in these cases, so that the effect of the ointment may penetrate to the roots of the hairs.

It should never be used in acute ulcers of the cornea.

White precipitate ointment (ung. hydrarg. ammon. dil.) is used in the more acute lid inflammations, and is preferable in these cases to the yellow oxide.

Fluorescein in a 2-per-cent. alkaline solution is used for staining purposes to demonstrate the presence of a corneal abrasion or an ulcer. No green stain ever appears where the epithelium is intact, and fluorescein therefore enables us to determine whether an ulcer is present. No harm can result from its instillation in any kind of case, and it should therefore form an essential adjunct to a general practitioner's stock of drugs for ophthalmic purposes.

Hot applications.—I shall have occasion to allude, under the different headings, to the use of hot applications in the treatment of the inflammations and other affections of the eye. They may be employed in three forms: (1) hot fomentations, (2) hot bathing, (3) continuous heat by

means of a hot box—i.e. a Japanese muff-warmer—or an electrical heating apparatus.

Hot fomentations are hardly suitable for affections of the eye, as they soon become cool.

Hot bathing is very effectual if used in the proper way. The lids must be closed and the eye bathed by applying to it a cotton-wool swab wrung out of water as hot as can be borne, the heat being kept up by the continual addition of boiling water, and the swab held on the eye until it begins to get cool. Frequent applications can be made over a period of five or ten minutes several times in the day. It will be found that after a time the eye can tolerate water much hotter than the fingers can bear ; it will then be necessary to wrap the cotton-wool swab round a non-conducting handle, such as a piece of wood, and apply the heat in that way.

Continuous heat is used by covering the eye with a thin layer of cotton-wool, then applying the heating apparatus, covered externally by a thick layer of wool and kept in position by a bandage.

Hot applications should *never* be used in superficial inflammations, such as conjunctivitis or corneal ulcer, but they are especially useful in deep inflammation of the eye, such as cyclitis, iritis, etc.

In some cases, after an abrasion or the removal of a foreign body, it is well to put a drop of oil into the eye in order to prevent friction between the upper lid and the cornea.

CHAPTER IV

OPERATIONS

UNLESS the general practitioner has performed operations on the eye himself, or has had the opportunity of seeing them constantly done by experts who have demonstrated the essential points in each operation, I strongly advise him to abstain from attempting any operation on the eye, especially of an intraocular nature.

Operations on the eye are so different from operations on other parts of the body that they require a special training, and it is quite impossible to apply to ophthalmic surgery one's knowledge of ordinary surgical operations. The small area in which the work has to be done; the minute points in technique on which so much depends (though to the inexperienced they are apparently trivial and overstressed); the performance of most operations under local anæsthesia, which leaves scope for apprehension as to the behaviour of the patient; the variable reaction of different eyes, ostensibly similar, to surgical interference—these are some of the causes which may well deter the general practitioner from undertaking operations on the eye.

It is enough for him to know the principles governing the various operations on the eye mentioned under the various headings, and particularly what conditions of the eye require *urgent* operations, and the reasons for advising his patient to undergo them.

Such cases are—(1) acute primary glaucoma, or increased tension of the eye from any cause; (2) prolapsed iris following perforating injury; (3) iris bombé, or an iris so tightly bound down as to be practically uninfluenced by the

action of atropine; (4) excision of the eye in cases of threatening sympathetic inflammation, or when the eye is quite blind (no P.L.) and is giving rise to pain; and (5) intraocular foreign bodies.

No eye with increased tension can be treated for long without surgical interference, as otherwise the condition must end in total blindness and the sight can never be recovered. For a short time it is permissible to temporize by means of instillation of eserine ($\frac{1}{2}$ or 1 per cent.) drops (except in the tension occasionally met with in corneal ulcers), hot bathing of the eye with lids closed, leeches to the temple, and a purgative to reduce the blood-pressure; and this treatment may be employed until arrangements can be made for the operation, but such measures cause only a temporary reduction in the intraocular pressure and can never be relied upon to produce any permanent effect.

In primary acute glaucoma an iridectomy is usually necessary, but in some cases of secondary glaucoma a paracentesis, repeatedly performed, often leads to definite reduction of pressure which may be lasting. A general anæsthetic is required for this operation.

Prolapsed iris after a perforating injury must be operated upon as early as possible; every day's delay increases the difficulties in the technique of the operation, as well as the risk of infection, which may endanger not only the injured eye but the other one as well.

Iris bombé may have to be operated upon in an acute stage, but preferably should be left until the eye has had the opportunity of quieting down, when the operation (iridectomy) is likely to be far more successful. It is generally possible to get some of the pupillary border of the iris to dilate by using strong atropine, etc.; this will save the situation for the time being and enable the acute inflammation to clear up. As soon as the inflammation has subsided and the eye has become quite free of injection

and remained so for a few weeks, an operation must be insisted upon ; otherwise the next attack may not be so easily controlled.

A general practitioner may undertake **excision of the eye** when he is perfectly satisfied that removal is necessary ; but it is always advisable in such cases to obtain a second opinion before performing the operation. There is no operation about which patients are more sensitive than the removal of an eye, and it is better to convince them first of the justification for taking such a step.

A general anæsthetic is usually necessary, though in old people, who do not bear a general anæsthetic well, it is quite possible to perform the operation under cocaine supplemented by hypodermic injection of novocain and adrenalin into the orbital cavity.

Technique of excision of the eyeball.—The instruments required are a speculum, one or two pairs of fixation forceps, a strabismus hook, and two pairs of scissors (a fine-pointed pair, and a stronger pair for cutting the optic nerve).

After the eye has been washed out with some boric-acid lotion or sterilized normal saline solution, the conjunctiva is grasped with fixation forceps at the upper part of the eye as near the cornea as possible, and a snip made with the fine pair of scissors at this point. By inserting one blade of the scissors into the hole thus made, the conjunctiva can be stripped up round one side of the circumference of the cornea, while with the other blade in position on the outside the membrane can be divided close up to the limbus all the way round until the lower part is reached ; then the same method is repeated on the other side of the eyeball until the two incisions meet below. It is important at this stage to remember that as little conjunctiva as possible must be left on the globe, since all that is available is required for the formation of the socket. While the conjunctiva is still held above, the subconjunctival tissue is divided by cutting the conjunctiva close to the globe

with the point of the scissors directed backwards; in this manner Tenon's capsule is opened, and the tenotomy hook can then be easily passed round each individual muscle, keeping the point of the hook close to the globe. Begin with the superior rectus, which is attached farther back than any of the other muscles and is therefore difficult to secure if the others have been divided first. Each muscle is separately divided all the way round, and when this has been done it will be found that by slightly pressing the speculum backward into the orbit the eyeball will shoot forward; if this does not happen, it is almost certain that some muscle or a portion of one still remains attached, and the strabismus hook must again be passed round the globe to find it.

When the eyeball comes forward it must be grasped with the left hand, and the stronger pair of scissors passed into the orbit close to the globe, on the outer side for the right eye, on the inner side for the left; the optic nerve is felt for with the point of the scissors, and can be easily recognized by its firm, cord-like sensation; the scissors are slightly withdrawn, the blades opened, and then pushed backwards as far as possible into the orbit and the nerve divided. The eyeball can now be easily secured in the left hand, and any remains of tissue or muscle cut off close to the globe. The bleeding which occurs at this stage may be free for a moment, but is easily controlled by pressure. The edges of the conjunctiva fall naturally into position, and no sutures are required. A gauze pad is placed over the closed lids, a small round pledget of gauze is put into the concavity, and another and thicker gauze pad placed over all; a bandage may then be firmly applied to prevent any possible hæmorrhage afterwards.

In excision of the eye of a child the eyeball does not readily come forward when the muscles are divided, as it is large compared with the width of the palpebral aperture; in this case it may be necessary to lever the eye out with

scissors pushed behind the globe, or the palpebral aperture may have to be enlarged by dividing the external canthus.

Another operation which the general practitioner may be called upon to perform, and ought, I think, to undertake, is the **removal of a Meibomian cyst.**

A local anæsthetic suffices in most cases, but if the cyst has become almost entirely fibrous, in addition to cocaine instilled into the eye, novocain and adrenalin must be injected under the skin of the lid over the position occupied by the cyst; the whole operation will then be painless.

Technique.—Evert the lid, and ask the patient to look down if the upper lid is to be operated on, or upwards if the cyst is situated in the lower lid; then, by keeping the finger pressed on the edge of the upper lid, or pushing upwards in a similar way on the edge of the lower lid, the Meibomian cyst can be exposed. There are also special ring forceps made for grasping and fixing the edge of the lid, and so arranged that the cyst projects through the ring that forms one blade of the forceps. An incision sufficiently large to facilitate the introduction of the small Volkmann's spoon specially designed for the purpose is now made at right angles to the margin of the lid. The contents of the cyst will project through the opening, and with the spoon these are thoroughly scraped out so that both the granulation tissue and the cyst-wall are completely removed; the scraping cannot be too thorough. The lid is then replaced, and a pad and bandage applied.

The patient should be warned that there may be a little thickening left for a time, but this will gradually become absorbed; and also that for a day or two afterwards the cyst may appear to be still present owing to the cavity which remains after the scraping becoming filled with blood.

CHAPTER V

AFFECTIONS OF THE EYELIDS

A GENERAL practitioner is often called upon to advise and treat cases of blepharitis, Meibomian cyst, and sties. If the rarer affections of the lids, such as primary syphilitic sore, gummata, and vaccinia, are suspected, it is often advisable to call in another opinion.

Blepharitis appears in two or three different forms, viz. (1) the moist type, in which the edges of the lids and surrounding skin are intensely red, with no formation of crusts, the whole area being moist and covered with a watery discharge; (2) a certain amount of acute inflammation with some incrustation on the surface; (3) a little redness with slight incrustation, or only fine white scales.

If blepharitis is allowed to become chronic, the ulceration produces thickening of the lids and contraction of the tarsal plate from formation of scar tissue, and in this way the hair-bulbs are destroyed and the cilia fall out; also the lids become rolled inwards, and any lashes that remain scratch the eyeball and produce considerable irritation of the cornea or sclera, often resulting in ulceration of the former. Another effect of this contraction is *ectropion* of the lower lid, which interferes with the drainage of lacrymal secretion owing to the punctum being pulled away from the globe, so that the fluid is continually flowing over the edge and keeping up the inflammation. In ectropion, active treatment will generally result in replacing the lid in position; if not, various operations have been devised for this purpose, though the practitioner will probably not care to undertake them himself.

The organisms most commonly concerned in blepharitis are the Morax-Axenfeld diplobacillus and staphylococci. Bad health and refractive errors act as predisposing causes, and until these are attended to the local treatment is sometimes of little value.

The treatment of blepharitis differs according to the type. In *moist* blepharitis the best treatment is to begin by massaging the edge of the lids with a cotton-wool swab on the end of a glass rod, dipped in protargol (20 per cent.); do this once or twice a week until the skin becomes moderately dry. At the same time wash out the eyes three times a day with a lotion containing boric acid (10 gr. to the ounce) and zinc sulphate (1–2 gr. to the ounce), and rub gently into the edge of the lids night and morning for two or three minutes some mild mercurial ointment (ung. hydrarg. amm. dil. 2 per cent.), leaving a little of the ointment on the edge of the lids at night to prevent them from sticking together, and being careful to wash off all traces of the ointment in the morning.

In the *second* variety no treatment is of the slightest use until the crusts have been removed, since they form a barrier which neither lotion nor ointment can penetrate. The first thing to be done, therefore, is to soften them down with hot bathing, and then dissolve them with bicarbonate-of-soda lotion (10 gr. to the ounce). Afterwards apply zinc lotion and white precipitate ointment as in moist blepharitis, replacing the ointment with one containing yellow oxide of mercury as soon as the blepharitis gets into a more quiet and chronic state. In the *third* variety, any crusts, however slight, having been removed as described above, the yellow oxide of mercury may be commenced at once.

A **Meibomian cyst** (Plate 1, Fig. 1, facing p. 60) originates in the blocking of the duct of a Meibomian gland, followed by inflammation or breaking down of the contents, due to some organism, and the whole gland is converted

into a single cavity containing granulation tissue or pus, more commonly the former. When the gland, from either of these causes, attains a certain size it becomes a plainly visible swelling just beyond the lash-bearing edge of the lid, but the skin moves freely over the surface and is seldom involved, unless suppuration has taken place. There is evidence of " pointing " on the conjunctival surface of the lids, as might be expected from the anatomical position of the gland ; however much the skin may become involved, there is always this pointing spot to be seen when the lid is everted, and this serves to distinguish the cyst from a sty. In suppurating Meibomian cysts, and also in some sties, there is often localized œdema of the conjunctiva (chemosis), which is greatest in the neighbourhood of the swelling, the remainder of the ocular conjunctiva having a normal appearance. This must be distinguished from general chemosis, which is one of the signs of inflammation and disease of the orbital cavity.

Meibomian cysts generally require surgical interference, but in the early stages, when the opening in the duct is only just beginning to be blocked with inspissated secretion, this can be removed, and the subsequent inflammatory reaction aborted by gentle massage of the edge of the lid against the globe. More often an incision is necessary, which should be made on the conjunctival surface of the lid at right angles to its edge, followed by a *thorough* scraping out of the contents of the cyst, as described in the last chapter (p. 49). Similar swellings are likely to occur again, and treatment on the same lines as for blepharitis should be carried out to prevent this, if possible.

A **hordeolum,** or **sty** (Plate 1, Fig. 2), is an acute inflammation of the sebaceous glands at the roots of the eyelashes. When the abscess forms it " points " at the edge of the lid at the base of one of the lashes. It is very painful, and is accompanied by a good deal of œdema of the lids. It is due originally to infection with

staphylococcus, and often a number of sties may form in different places, one after the other.

A sty seldom requires operative interference, and generally the pus contained in it is discharged under the frequent application of hot bathing; at the most a small incision parallel to the edge of the lid, when the swelling is actually pointing, is sufficient. As soon as the lid becomes less inflamed, treat the case as one of blepharitis, with a lotion containing boric acid and zinc sulphate (*see* p. 51), and gently massage the edge of the lid with yellow oxide of mercury ointment. When this has failed to prevent recurrence, injection of staphylococcic vaccine has been employed with excellent results.

Attention to the general health, specially directed towards the discovery of any particular source of infection, is of the greatest importance. If errors of refraction are present, glasses should be ordered, though it is possible that all that glasses do in these cases is to afford protection to the lids.

CHAPTER VI

LACRYMAL AFFECTIONS

FLUIDS for the moistening of the eyeball are secreted by the lacrymal gland, the mucous glands of the conjunctiva, and other glands situated near the edge of the lid and in the fornices; the greater part is furnished by the smaller glands, and the actual tears by the lacrymal gland, of which there are two parts, the orbital and the palpebral. The lacrymal fluid is slightly alkaline; it is only secreted in any abundance under the influence of irritation (as from a foreign body or a cold wind), or of emotion, and any excess drains away through the puncta, the canaliculi, and the lacrymal duct into the nose. The ordinary moistening fluids of the eyeball disappear by evaporation; under perfectly normal conditions, therefore, the lacrymal duct and passages are very seldom used.

The lacrymal gland sometimes becomes inflamed (*dacryocystitis*), when a very tender red swelling forms at the outer part of the orbit just beneath the supraorbital margin, filling in the sulcus between the edge of the bone and the eyeball, so that it is impossible to pass the finger between the globe and the bone. If such inflammatory swellings are treated with hot fomentations they often subside, though occasionally pus is formed, and has to be evacuated by an incision into the gland parallel to the upper margin of the orbit.

Any interference with the passage of tears through the punctum, canaliculus, or lacrymal duct causes the eye to water (*dacryops*). The various causes of this failure of drainage must be systematically investigated.

The punctum may be too small, or it may not be applied

to the globe owing to a certain amount of eversion of the lower lid. Or the canaliculus may be involved in cicatricial scar tissue, and its channel blocked or even obliterated altogether. Or, again, the nasal duct may be obstructed in any part of its course, the most frequent place being at the nasal end in the early stages of nasal catarrh, either acute or chronic. This leads to inflammation and swelling of the mucous membrane, which destroys the patency of the canal, at any time merely a potential channel, and thus the pent-up secretion, loaded with organisms of a very virulent type, causes inflammation of the lacrymal sac, and an accumulation of muco-purulent material appears in this cavity, which is situated between the nose and the inner canthus. It is a very dangerous condition, since the presence of muco-purulent discharge containing virulent organisms so near the eye and actually regurgitating into the conjunctival cavity may easily infect any ulcer, abrasion, puncture of the cornea, or operation wound, and result in the loss of the eye. It is essential, therefore, that inflammation of the lacrymal sac and duct be treated vigorously, and if it does not respond to the treatment to be described later the sac must be excised.

The two conditions, therefore, which a general practitioner may be called upon to advise about are (1) **simple watering, or a mucoid discharge, from the lacrymal sac** without the formation of an abscess, and (2) **abscess in the lacrymal sac.**

With regard to the first of these, we must ascertain as soon as possible whether the duct is patent. How this may be done is described at p. 7. If the duct is patent there is nothing to be gained by endeavours to enlarge the channel. All probing of the duct and slitting up of the canaliculus should be studiously avoided; whether in any circumstances it is the right treatment is a matter about which there is still some divergence of opinion amongst ophthalmologists, though the general feeling is decidedly

growing against the use of such measures; but from the general practitioner's point of view I have no doubt whatever that operative interference with the lacrymal apparatus, beyond the opening of an abscess, is attended with unjustifiable risks.

The old treatment of obstruction of the lacrymal duct was to dilate the passage with graduated probes, beginning with small ones, and eventually, when the largest size was reached, to pass it periodically in order to keep the passage open, the condition being treated in the same way as stricture of the œsophagus or urethra. The essential difference is that the lacrymal duct is bounded by bony structures, and the œsophagus and urethra by soft parts, so that the lacrymal duct can only be enlarged at the expense of the bone and surrounding parts, which are crushed and broken, causing an excessive degree of pain. Moreover, when the probing is discontinued the formation of callus and cicatricial tissue constricts the duct more than ever, and the anticipation of pain every time the probe is passed leads the patient at last to cease attendance, when the symptoms will recur as badly as before this somewhat brutal method of treatment was instituted.

If probes are passed at all, only the very finest ones should be used, and even so a good deal of care and gentleness in technique is required to negotiate the normal passage successfully. The most suitable cases for such treatment are those in which the trouble is caused not by actual constriction of the duct but by a plug of mucus, as in congenital stenosis. Occasionally a similar condition is found in adults. Congenital stenosis can sometimes be cured even without probing, by squeezing out the contents every day by means of pressure with the finger over the sac, and afterwards washing away all discharge with a little boric-acid lotion; if this is not sufficient, the passage of a fine probe once under an anæsthetic will generally effect a cure.

In adults, if the punctum is too small, or not properly applied to the globe owing to ectropion, it may be slightly enlarged on its conjunctival surface and the position of the lid rectified by a slight operation. When there is much inflammation of the lacrymal sac with retention of muco-purulent secretion, causing constant irritation, repeated syringings two or three times a week to wash the sac clean, together with an occasional injection of protargol or sulphate of zinc into the sac to make the discharge less abundant, will sometimes re-establish a normal passage, if persevered in for several weeks or months. More often, efforts to lessen the secretion are not attended with success, and sooner or later an abscess forms, and when it has reached any considerable size a large tender red swelling appears between the inner canthus and the nose, and eventually points below the internal tarsal ligament. The only treatment in these circumstances is to apply hot fomentations and to make an incision as soon as the pus distinctly shows beneath the surface. Afterwards the cavity should be plugged with gauze to encourage the abscess cavity to heal from the bottom. Syringing or investigation of the lacrymal passages at this stage is never permissible.

When an abscess has once formed, I am disposed to think that the right treatment is to excise the sac, after all symptoms of inflammation have completely subsided, though sometimes during the healing process all traces of the passages are obliterated by cicatricial tissue ; but this is not always the case, and frequently many little isolated pockets of lacrymal duct are left which give rise to trouble in the future. Another indication for excision is thickening of the walls of the duct from chronic inflammation extending over a long period, so that there is a constant discharge, however thoroughly the sac may have been washed out. But for decision on this point, and indeed when any operation on the lacrymal sac and duct is in question, an expert opinion is advisable.

Most cases of lacrymal obstruction, in my opinion, originate in some nasal affection, and therefore I always advise a careful examination of the nasal cavities in the initial stage.

If there is regurgitation of watery fluid only, without any tendency to the formation of muco-purulent material, and no definite obstruction in any of the passages, the treatment is largely dependent on the amount of discomfort the patient experiences. Many cases never advance beyond this stage, and, since many persons find it no great hardship to suffer slightly from " watery eyes " in the wind and cold, no treatment in such cases is necessary.

CHAPTER VII

AFFECTIONS OF THE CONJUNCTIVA

Conjunctivitis is a very common affection in one form or another, and one that the general practitioner is expected to treat and cure, but in order to ensure success he must recognize that there are different types, each needing its own special treatment.

Anatomically, the conjunctiva consists of two layers of spongy fibrous stroma enclosing mononuclear cells and lined on the surface of the lids with stratified epithelium. It covers the inner surface of the lids, is firmly attached to them, and is reflected on to the eyeball at the fornices, where it forms a number of folds to allow of free movement of the eye in all directions.

Signs.—When the conjunctiva is inflamed there is injection of the blood-vessels, the redness varying in intensity according to the severity of the inflammation. In some cases the whole of the sclerotic and the inner surface of the lids become bright scarlet, with a certain amount of swelling of the mucous membrane, so that the individual blood-vessels, so plainly seen in a healthy conjunctiva, are completely hidden. In other cases the redness is localized to different parts of the conjunctiva, according to the special type that prevails. This is accompanied by a mucoid, muco-purulent, or purulent discharge, which varies in amount, but, owing to the fact that it is always of a mucoid nature, the lids become glued together during sleep.

All cases of conjunctivitis have these two signs in a greater or less degree—redness and a mucoid discharge; mere watering of the eye, however profuse, can never

cause the lids to stick together. Whenever these signs are in evidence, therefore, conjunctivitis is necessarily present, although other diseases may coexist.

Both eyes are generally affected, but one shortly before the other. When conjunctivitis remains monocular for any length of time and defies all the ordinary methods of treatment, either it belongs to one of the rarer forms or else some complication should be suspected, and a more thorough examination must be made or a second opinion obtained.

The **symptoms** of conjunctivitis consist of discomfort, soreness, itching, heaviness of the lids, etc., in different degrees, but there is no pain or photophobia; when these latter symptoms occur it generally means that the cornea has become secondarily affected.

Conjunctivitis may be either acute or chronic, the acute cases being associated with much and the chronic with little discharge; and from the practitioner's point of view all cases of conjunctivitis may be classed in one or other of these groups. The various forms of conjunctivitis are caused by different organisms—e.g. staphylococcus, pneumococcus, the gonococcus, the Koch-Weeks bacillus, the Morax-Axenfeld diplobacillus, and the colon bacillus. Some of these are more virulent than others, but to recognize them requires an expert examination, for many organisms found in the conjunctival sac are quite innocent and yet may be morphologically indistinguishable from the highly virulent ones, so that a hurried staining of a smear from the secretion may be actually misleading. It is a good plan in some acute cases to prepare a specimen as soon as the patient comes under observation, but it is very unwise to delay treatment until an expert report has been received, since the methods to be employed are very similar in all cases, both acute and chronic, and delay might lead to complications which could easily have been avoided. Examples of acute conjunctivitis are

Fig. 1.—Meibomian cyst.

Fig. 2.—Sty.

Fig. 3.—Catarrhal conjunctivitis.

Fig. 4.—Phlyctenular conjunctivitis.

Fig. 5.—Angular conjunctivitis.

Fig. 6.—Follicular conjunctivitis.

PLATE 1.

catarrhal conjunctivitis, gonorrhœal conjunctivitis and ophthalmia neonatorum, diphtheritic or membranous conjunctivitis, phlyctenular conjunctivitis, trachoma, and the conjunctivitis following measles and scarlet fever; while chronic types are the angular, the follicular, and spring catarrh. Some of these are rare, and the practitioner may seldom meet with them, but he should have some idea of the leading features of each, in case he should be confronted with a case which does not yield to ordinary treatment in a reasonable time, when the rarer forms may be suspected. The appearance presented by the eye in catarrhal conjunctivitis is shown in Plate 1, Fig. 3.

Principles of treatment.—The general principles to follow in the treatment of all cases of conjunctivitis, whether acute or chronic, are to wash out the eye several times a day (the more acute the inflammation the more frequent the washing out) with some form of lotion (e.g. boric acid 2 per cent. or perchloride of mercury 1 : 7,000) and apply a little vaselin or boric ointment along the edge of the lids at night to prevent them from sticking in the morning. I have noticed that practitioners often omit to prescribe the ointment, and in ordering a lotion fail to give careful directions as to how it is to be used, and there can be no doubt that many cases "hang fire" because the lids, being securely closed during the night, form a favourable nidus for the growth of organisms, which continue the irritation during the day. Quinine lotion (3 gr. of the hydrochloride to the ounce) is also very useful in acute conjunctivitis. The right way to wash out the eyes is to pour the fluid, which should be slightly warmed, from an undine (Fig. 3), or some receptacle with a narrow spout, into the eye from a definite height, after separating the lids with the fingers. In this way the discharge is washed away by the mechanical force of the liquid. This washing away is important, because no lotion can be made strong enough to destroy the organisms without doing harm to

the structure of the eye, though their growth can be materially inhibited. The patient himself may be directed to use an eye-bath, which is not quite so effectual, but has the advantage of making him independent of help. In children it is best that they should lie on the back when the eyes are washed out; and the lids must be separated as described in Chapter I (pp. 6-7).

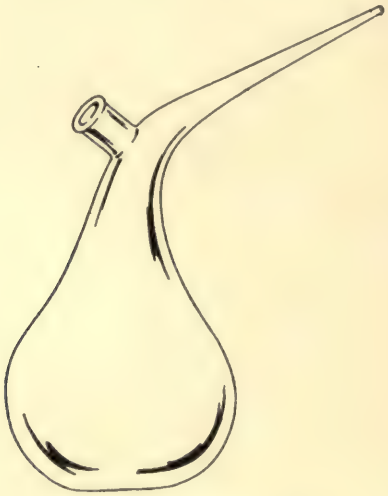

Fig. 3.—Undine.

In any specially stubborn variety of conjunctivitis the lids may be everted and their conjunctival surface painted with protargol (20 or 30 per cent.), and, if this is not successful, with silver nitrate (2 per cent.), applied by means of a cotton-wool swab on the end of a glass rod, once or twice a week, but not more often than this, except in a purulent case, when a daily application is necessary.

In chronic conjunctivitis a lotion containing zinc sulphate (1–3 gr. to the ounce) is better than boric acid or perchloride of mercury; it is rendered more effective if

combined with the 1 : 1,000 adrenalin solution (½ dr. to the ounce).

As nearly all forms of conjunctivitis are contagious, though some more so than others, the patient's friends should be warned to keep his towels, handkerchiefs, etc., separate from others, for the infection may quickly spread to all; and those in attendance should be scrupulously careful to wash their hands and to avoid infecting their own eyes while washing out the eyes of the patient.

In no circumstances should an eye be tied up with a bandage in conjunctivitis, no matter what complications may be present. A common idea in the public mind is that, whatever is wrong with the eyes, especially if there is any pain or photophobia, light should be excluded, either by confinement in a dark room or by tying the eyes up tightly, and even hot fomentations are sometimes applied. There are some diseases in which the eyes are undoubtedly better for being tied up, but in all cases of conjunctivitis the practitioner must insist that the eyes be not wrapped up, but only protected, if necessary, with a shade or with dark glasses.

An ordinary acute catarrhal conjunctivitis will generally get well in a week or ten days under the simple treatment here prescribed; but the purulent types require special lines of treatment in addition to the use of the lotion and ointment.

Purulent conjunctivitis.—The commonest forms of purulent conjunctivitis which come under the general practitioner's notice are ophthalmia neonatorum and the gonorrhœal conjunctivitis of adults. In the majority of cases purulent conjunctivitis is due to the gonococcus, but in infants it may be due to other virulent organisms, e.g. the streptococcus and the Bacillus coli. Even if the diagnosis has been made by an expert, the treatment of the case largely rests with the practitioner. In addition to the signs and symptoms enumerated above, common to all cases of conjunctivitis, the characteristic features of purulent conjunctivitis

are that after a short incubation period (three days in infants and often less in adults) the discharge becomes very profuse, welling up between the lids as soon as they are separated, and that the mucous membrane looks swollen and distinctly œdematous, an unusual accompaniment of any ordinary conjunctivitis.

Treatment.—Apart from the methods of prophylaxis —washing the baby's head and shoulders as soon as it is born, and instilling a drop of 2-per-cent. silver-nitrate solution as soon after birth as possible, which is by far the most important; and in adults the protection of the eyes in presence of contagion—the proper line of treatment is to wash out the eyes with perchloride-of-mercury lotion (1 : 7,000) every hour in the day and every four hours in the night, i.e. to aim at continuous irrigation as far as is compatible with the taking of meals and obtaining sleep and rest, always being careful to apply ointment to the lids whenever the patient is about to sleep. At the same time steps must be taken to protect the other eye if still unaffected. To attain this object a Buller's shield must be fixed over the sound eye with strapping, special attention being paid to the nasal side so that no discharge can approach from the affected eye across the bridge of the nose; an outlet should be left on the outer side sufficient to allow a drainage-tube to be inserted so that there may be no accumulation of moisture on the inner surface of the glass. The lids must be everted (*see* p. 6), and painted *once a day only* with 2-per-cent. silver nitrate by means of a swab of cotton-wool fixed on the end of a glass rod; when this painting is carried out properly it will be noticed that the conjunctiva becomes blanched, showing that the epithelium, together with the gonococci contained in it, has been destroyed. There is no need to neutralize with sodium-chloride solution; all that is necessary is to mop up any superfluous fluid with a cotton-wool pad wrung out of boric-acid lotion.

Now one or two words about this painting. Never use stronger solution than 2 per cent., never paint the lids more than once a day, and never use the strongest preparation (i.e. silver nitrate) in the absence of discharge. As soon as the discharge becomes decidedly less it is better to employ weaker remedies, such as protargol 20 per cent., and a milder lotion ; in this way the effects, to be mentioned immediately, of over-zealous treatment can be best avoided, and there is perhaps no class of case which, when it has got into a more chronic state, responds better to a different line of treatment than does this.

The efficacy of silver nitrate in the treatment of ophthalmia neonatorum is well known to the general practitioner. Undoubtedly the systematic prophylactic instillation of a drop of silver nitrate (2 per cent.) into the eyes of newly born infants has materially lessened the number of such cases, but it must not be assumed that this preparation can be used indiscriminately by unskilled persons for any length of time. Daily application of silver salts, except as described above, will give rise to silver staining of the conjunctiva (argyrosis), which is not only permanent but may also produce ulceration of the cornea.

Knowing that the silver salts are efficacious, the practitioner is often so eager to effect a rapid cure in what is admittedly a dangerous type of case that he sometimes applies it too vigorously and causes the very complication which he has been so anxious to avoid ; that is to say, the influence of the caustic extends more deeply than is intended, and in this way, as well as by its action on the cornea, destruction and sloughing of the latter structure may take place. The mischief is mistaken for damage produced by the original infection, and leads to renewed efforts with the silver nitrate, with disastrous results. It is important to realize that the effect of the painting is to destroy the surface epithelium, which takes at least twenty-four hours to be renewed, and that if painting is

resorted to more often than once a day the subepithelial structure may be destroyed and other complications may arise. The discharge often remains very copious for several weeks, and in a well-developed case the practitioner must not expect to see a diminution in a short time, but must patiently carry out the treatment as described above. In due course the discharge will gradually cease; the painting must then be stopped and only lotion used. He must not forget to protect his own eyes by wearing goggles when in attendance upon the case, and must also be scrupulously careful in washing his hands afterwards.

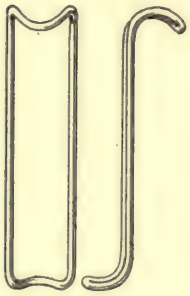

Fig. 4.—Retractors.

The liability of the cornea to become involved is a feature of all cases of purulent conjunctivitis. Once ulceration has begun, it may rapidly extend through the substance of the cornea, perforate and infect the interior of the eye and produce panophthalmitis, and the eye is lost. Every day, therefore, the cornea must be carefully inspected, the lids being drawn apart, if necessary, by retractors (Fig. 4), since any careless manipulation with the fingers may easily cause a scratch on the cornea, which quickly becomes infected. As soon as the cornea appears in the slightest degree hazy, atropine drops or ointment (1 per cent.) must be used, and "pushed" until complete dilatation of the pupil is assured, so that in the event of a perforation occurring there may be less likelihood of inclusion of the iris in the wound.

When lying down, or on going to bed, the patient must be directed to lie on the affected side, so as to encourage the discharge to drain away freely without infecting the sound eye.

All forms of acute conjunctivitis with profuse discharge, whatever the causal organism, can be treated in the way

described, with but one exception, viz. diphtheritic conjunctivitis, in which painting the lids with silver salts should never be done, the membrane being left to exfoliate by itself. In a bacteriologically established case of diphtheritic conjunctivitis the antitoxin injections must be commenced at once; the earlier they are instituted, the better the result to be expected.

Phlyctenular conjunctivitis (Plate 1, Fig. 4) is occasionally met with in private practice, but not so commonly as in hospital work, since it is an affection almost exclusively found in badly nourished children with a tuberculous tendency living in an unhygienic environment. It often shows itself merely as an irritability, with sensitiveness to light, accompanied by some watering of the eyes and slight conjunctival injection. In a more typical form one or more small localized yellowish-white swellings appear at the sclero-corneal margin, with dilatation of the blood-vessels round them. These elevations consist of collections of lymphoid cells beneath the epithelium in the submucous tissue, induced by toxic absorption, usually from some tuberculous focus. No organisms have ever been found locally, though it has been proved that the presence of staphylococci aggravates the condition. The epithelium covering these swellings may necrose, leaving small ulcers in the conjunctiva.

The **symptoms** are the same as in other forms of conjunctivitis, though of a milder type; in addition, the patient has a sense of discomfort which it is difficult for him to explain. As in other kinds of conjunctivitis, there is no photophobia unless the cornea is involved. This, however, is very likely to happen, so that when photophobia is present we may conclude that there is some ulceration of the cornea, and must vary the treatment accordingly.

The condition is rare in adults, and if a localized injection which resembles a phlyctenule is seen at the margin

of the cornea in them, the probability is that it is an inflammation of the deeper structures, viz. episcleritis.

The **diagnosis** is of importance from a prognostic point of view, for whereas phlyctenular conjunctivitis is comparatively easy to cure, unless it has already spread to the cornea and become an ulcer, episcleritis is likely to be of much longer duration, and the severer forms may give rise to other complications, e.g. cyclitis.

Treatment.—In a purely conjunctival case, the best treatment is to wash out the eye with some slightly stimulating lotion, usually perchloride of mercury (1 : 7,000), and introduce a little simple ointment, following this up by gentle massage over the eyeball with the closed lid. Yellow oxide of mercury, which seems to be invariably advocated in this form of conjunctivitis, is seldom necessary, often produces considerable irritation, and is positively harmful when a corneal ulcer is present. It seems to me inconsistent that the advocates of rest by means of atropine " pushed " to full dilatation of the pupil, together with measures to protect from all sources of irritation, in every other form of corneal ulceration—which is undoubtedly the right treatment—should prescribe a definitely stimulating ointment when the ulceration is due to a phlyctenule. If the phlyctenule spreads to the cornea, as shown by the presence of photophobia and a definite area which stains with fluorescein, the case must be treated as corneal, and no longer as one of conjunctivitis alone. Since ill-health is a predisposing cause and enlarged glands in the neck are a common accompaniment, an indispensable part of successful treatment consists in the administration of tonics, attention to general hygiene, a change of air, preferably to the seaside, and removal of the cervical glands if they are obviously enlarged.

Chronic conjunctivitis appears in one or two typical forms which can be easily recognized when once the diagnostic features are pointed out. The practitioner must

learn the difference between these and the acute forms, for, although they do not produce such alarming symptoms, they cause the patient a considerable amount of discomfort and worry which he feels his doctor ought to be able to remove. Moreover, the condition may be aggravated by a number of causes which it is difficult to eliminate for various reasons, and therefore the lotions usually prescribed are not always successful.

The *angular* type, due to the Morax-Axenfeld diplobacillus, gets its name from the fact that the inflammation appears only at the inner and outer canthi, and to a certain extent along the conjunctival edge of the lids ; sometimes also there is excoriation of the skin in the same place ; the ocular conjunctiva remains, as a rule, unaffected (Plate 1, Fig. 5). Discharge is scanty, but is sufficient to stick the lids together at night, and it persists for a long time if not properly treated.

Another form of chronic conjunctivitis is the *follicular*, in which parallel rows of enlarged follicles are found in the fornices together with some general velvety condition of the conjunctiva (Plate 1, Fig. 6). These must not be mistaken for the granulations seen in trachoma, which attacks all parts of the conjunctiva equally, and is accompanied by inflammation of the upper quadrant of the cornea. Follicular conjunctivitis occurs in cases where there are adenoid enlargements in other parts of the body, e.g. the tonsils.

The **treatment** of chronic conjunctivitis is to wash out the eyes with a lotion containing zinc sulphate (1–2 gr. to the ounce), which is a specific for the diplobacillus ; with it should be combined some adrenalin (20 min. of the 1 : 1,000 solution to the ounce), and the application of ointment to the lids at night. The stronger preparations of zinc are required for follicular conjunctivitis, but it is best to begin with much weaker ones for the angular variety, as some patients do not tolerate well the higher percentages.

Practically all forms of chronic conjunctivitis are benefited by a zinc lotion.

In any specially stubborn variety the lids may be everted and their conjunctival surface painted with 10- or 20-per-cent. protargol, or even with silver nitrate 2 per cent., but not more than twice a week and never so frequently as in acute purulent conjunctivitis; while as soon as improvement takes place the painting must cease.

Chronic conjunctivitis may be aggravated, or even caused, by errors of refraction, so that when in any case the symptoms do not tend to diminish under the above treatment, any error of refraction must be corrected and suitable glasses ordered. It is quite possible, however, that the wearing of glasses only benefits the conjunctivitis by affording protection against the irritation of dust, cold, etc. These irritations, and also smoke, dust, late hours, bad air, working continually in badly arranged artificial light, etc., all tend to make the condition more difficult to cure.

Irritative conjunctivitis from various causes, e.g. irritating liquids and gases, glare from snow and electric light, may come for treatment, and it is important to recognize this form, as the symptoms are very worrying to the patient, though not really serious. It very rarely spreads to the cornea, so that we need not fear that complication as in some other forms. Since it is not due to organisms, it is not necessary to apply boric-acid or perchloride lotions, which often add to the irritation; a mild alkaline lotion, or even boiled water, may be used for washing out the eyes, and neutral-tinted glasses used to exclude the light.

The practitioner must be on the look-out for some of the rarer forms of conjunctivitis, though it may be wise of him not to undertake the treatment of them entirely on his own responsibility. A case of this nature may be suspected if the inflammation shows no material improvement, resists all the methods of treatment here

Fig. 1.—Trachoma.

Fig. 2.—Pinguicula.

Fig. 3.—Pterygium.

Fig. 4.—Subconjunctival ecchymosis.

Fig. 5.—Phlyctenular corneal ulcer.

Fig. 6.—Catarrhal corneal ulcer.

PLATE 2.

described, and remains monocular for a long time, though eventually attacking the other eye in spite of efforts to prevent it. In these circumstances it is advisable to evert the lid and make a thorough examination of the conjunctiva on its inner surface ; in this way trachoma, a conjunctival growth, or some unusual foreign body may be detected, and special treatment must be adopted.

Trachoma is rare in England, but is endemic in certain parts of the world, e.g. Russia and Poland, and flourishes wherever people are crowded together in unhealthy surroundings. It can generally be recognized by the fact that, in addition to the ordinary signs of conjunctivitis, the whole of the conjunctiva, both palpebral and ocular, is covered with numerous sago-like granulations (Plate 2, Fig. 1); it thus differs from follicular conjunctivitis, and there is, in addition, some general swelling of the mucous membrane. The granulations consist of lymphocytic infiltration of the adenoid layer caused by the trachoma organism, which, however, has not yet been discovered. There is a certain amount of discharge, and the cornea, especially the upper quadrant, is sure to be involved sooner or later, the lymphoid infiltration consisting of granulation tissue and blood-vessels which push their way between the epithelium and Bowman's membrane and give rise to trachomatous pannus, a direct infection from the upper lid. In a well-advanced case the epithelium gives way in places and corneal ulcers are formed. Follicular conjunctivitis never attacks the cornea.

The disease is extremely contagious, and every care should be exercised to prevent the spread of infection, as in any other virulent conjunctivitis.

The **treatment** consists partly in washing out the eyes with some perchloride-of-mercury lotion, but the main thing is to destroy the granulations as soon as possible, together with as much of the subconjunctival tissue, in which fresh ones are growing, as is safe. This is accom-

plished by the use of various caustics, such as silver nitrate (2 per cent.), copper sulphate stick, or CO_2 snow, and by the operation of expression followed by painting with 1 : 200 perchloride of mercury. The best application for the practitioner to use is silver nitrate, in the same way as in ophthalmia neonatorum. Trachoma is a subacute condition, which goes on for a very long time, new granulations continually growing up to take the place of those destroyed nearer the surface, and often when it appears to be cured it breaks out again in some fresh place.

The copper sulphate painting is more suitable for the later stage, and as soon as the disease is beginning to subside, the painting must be considerably reduced in frequency and finally stopped.

Such a severe and longstanding inflammation, involving the whole thickness of the conjunctiva and tarsal plate, produces contraction of the tissue, so that the sequelæ of trachoma are entropion of the upper lid with ingrowing of the lashes, and generally permanent corneal nebulæ.

Another rare form of conjunctivitis is the **diphtheritic conjunctivitis** associated with the formation of a membrane, and due to the Klebs-Loeffler bacillus, though some membranous cases are due to the streptococcus, the pneumococcus, Friedländer's bacillus, etc. The lids are swollen, and there is often a muco-purulent blood-stained discharge, and the preauricular gland is generally enlarged.

The difficulty of proving the presence of the diphtheritic bacillus is great, and there is no relationship between the severity of the condition and the presence of the typical organism. Only expert bacteriological investigation can settle this point, and in the meantime treatment must not be delayed. From the practitioner's point of view, if there is any doubt in his mind he must isolate the patient and carry on local treatment vigorously, by washing out the eye with perchloride-of-mercury lotion and smearing some ointment along the edge of the lids at night, as in

other acute conditions; but in these cases the lids must never be painted with silver nitrate or any similar salt. Quinine hydrochloride lotion (3 gr. to the ounce) is extremely useful in this and in any other form of acute conjunctivitis which shows no sign of clearing up quickly enough. If the presence of the diphtheria bacillus is definitely proved, antitoxin must immediately be given; and it may be used in any case of doubt, since no harm results.

The general health is seriously affected, and must always receive attention.

The cornea sometimes becomes involved, and the inflammatory process may progress to sloughing and perforation.

When the condition begins to subside, and the membrane separates off, there is danger of adhesions forming between the palpebral and the ocular conjunctiva, which can easily be prevented by passing a glass rod daily between the two in order to separate any fibrous tissue strands while they are still small and loosely attached.

The conjunctivitis associated with measles and scarlet fever is more or less of this type, and particular attention should be paid to the condition of the eye in these diseases, in case the cornea should become inflamed, when perforation sometimes occurs.

Yet another unusual disease of the conjunctiva is **spring catarrh,** which in its typical form shows relatively large flat-topped outgrowths of the conjunctiva arranged like cobble-stones all over the tarsal plate of the upper lid, associated with a slight milky secretion. It is common in the summer months, is often seen in young children, and causes a great deal of irritation.

The **treatment** consists in washing out the eyes with a lotion of dilute acetic acid (3 min. to the ounce) combined with some adrenalin (1 : 1,000, about ½ dr. to the ounce) in distilled water.

A general practitioner's opinion is often asked regarding chalky concretions of the conjunctiva, pinguicula, ptery-

gium, and subconjunctival ecchymosis. Patients suddenly notice such things and become anxious lest they should affect the sight.

Concretions do not often give rise to much trouble when they are covered by normal epithelium, but if they definitely push their way through to the surface and irritate the globe, which they sometimes do, they can easily be pricked out with a needle under cocaine, when considerable relief is often experienced.

Pinguicula, an overgrowth of the conjunctival tissue found on the nasal and temporal sides of the globe near the sclero-corneal margin, in the region of the palpebral aperture (Plate 2, Fig. 2), is commoner in people exposed to wind and dust, and is composed of yellow elastic fibrous tissue. People get alarmed about this and ask " whether it will grow over the sight." The practitioner may confidently say that it will not. Hardly ever has it to be interfered with surgically.

Pterygium, an encroachment of the conjunctiva on to the cornea, is usually of a triangular shape, and is situated on the nasal side of the globe in the horizontal meridian —that part of the eyeball which is exposed between the lids (Plate 2, Fig. 3). It need not be interfered with unless it grows rapidly on to the cornea and threatens to involve the centre, when it can be dissected off, but a nebula of variable density always remains, and the pterygium is very liable to recur.

Subconjunctival ecchymosis (Plate 2, Fig. 4), which generally occurs as the result of some excessive muscular strain, shows that the delicate blood-vessels are not in a perfectly healthy state and have given way under increased blood-pressure. It is symptomatic, and the general health, especially the vascular system, should be thoroughly overhauled, and warning given against over-exertion, both mental and bodily. A large and extensive ecchymosis is, of course, seen in fractured base of the skull.

CHAPTER VIII

AFFECTIONS OF THE CORNEA AND SCLERA

1. Corneal Affections

These affections appear usually either as ulcerations of various types, with special characteristics according to the organism or toxin which is present, or as interstitial keratitis; but it is not necessary for the general practitioner to commit himself to any definite diagnosis, since the principles of treatment are practically the same in all forms of **corneal inflammation.** His immediate need is to make sure at once whether there is any existing ulceration, a point about which he is frequently in doubt. There is no real difficulty, however, in deciding the question. If the practitioner uses the fluorescein-stain test as mentioned in Chapter I (p. 10) he can very easily resolve his doubts, for any part of the surface of the cornea which is denuded of epithelium will show the characteristic green colour. Some of the ulcers are so small that the corneal magnifying lens must be used, but with this there is practically no form of ulcer which can escape observation.

The **symptoms** of all corneal inflammations are—(1) ciliary injection; (2) pain; (3) photophobia; (4) a considerable amount of watery discharge, the lids, however, never being glued together at night as in conjunctivitis, though this may be present as a complication; (5) loss of brilliancy of the cornea. The pricking pain is very suggestive, even though, as in some early stages, no definite loss of tissue can be detected even by the fluorescein test. It is due to exposure of the corneal nerve-endings; but in some forms of ulcer where the destruction of tissue is very rapid the nerve-endings are so quickly destroyed

that any pain which is experienced is confined to the early stages and soon disappears altogether. The absence of pain is generally a bad sign, and this will be alluded to later on.

Treatment.—All forms of corneal inflammation must be treated by washing out the conjunctival sac with some non-irritating antiseptic lotion as for simple conjunctivitis, and applying atropine in the form of drops or ointment (½ to 1 per cent.), *no matter where the ulcer may be*, pressing it until full dilatation of the pupil is secured, and maintaining the dilatation as long as there is the slightest sign of inflammation, and for some little time afterwards ; this undoubtedly hastens recovery and tends to prevent complications in those ulcers which are likely to perforate. Provided there is no conjunctival discharge, the eye should be tied up, and irritation from bright light guarded against by wearing neutral-tinted glasses or a shade ; this is better than confinement in a dark room, which is apt to become depressing. Attention to the general health is also necessary. Additional methods of treatment are applicable only in special types of ulceration, which can be diagnosed without any very great difficulty when once their characteristic features are pointed out ; these will be mentioned under separate headings later in this chapter. It is advisable, in these circumstances, for the general practitioner to obtain expert advice, even though he may be perfectly well aware of the right course to pursue. A good deal of technique and judgment is required to carry treatment to a successful issue, and he is not likely to have had the opportunity of acquiring the necessary experience. The pain is sometimes so severe that he is forced to consider what additional remedies he can apply to relieve it, and his thoughts naturally turn to hot fomentations and cocaine. I do not hesitate to say that both of these methods of combating the pain are wrong and should never be resorted to. The former soddens the epithelium, which tends to break down and

increase the ulceration, and while keeping the parts warm it only encourages the growth of organisms which continually re-infect the ulcer and increase the area of ulceration; in any case it only affords temporary relief. Keeping the eye tied up and well under the influence of atropine is more likely to relieve pain than anything else, and the practitioner should never be tempted to deviate from this line of treatment. The pain is caused mostly by the scratching of the lid over the ulcer and by exposure to light. I should add, however, that the application of a couple of leeches to the temple is an extremely useful means of relieving pain connected with the eye, whatever its nature, and this remedy should always be tried.

Some ulcers of the cornea are associated with increased tension, which always gives rise to intense and constant pain. It is well to remember this, and occasionally to test the tension in this and in all other ocular inflammations. No ulcer will ever heal in an eye that is harder than normal, and as a slight operation (paracentesis) is desirable for relieving the tension, at any rate temporarily, it is better to seek expert advice when this has to be done.

Certain corneal ulcers tend to perforate, while others do not. As perforation leads to serious complications which have to be dealt with surgically, the possibility of perforation should always be present to the practitioner's mind. At the same time, it is difficult for him to perceive when perforation is imminent, for a considerable amount of experience is required to observe the special signs; but if he remembers the kind of ulcer likely to perforate, he will not fail to anticipate the event if an ulcer remains in an acute stage for any length of time and does not respond to the methods of treatment that have been described. The best way to avoid this complication and to promote rapid healing is to keep the pupil well dilated during the whole time that ulceration is present, by pressing

atropine until all signs of inflammation have subsided and been absent for some weeks.

There seems to be a fear in some practitioners' minds that harm may result from the prolonged use of atropine, but this is largely a fallacy and certainly does not apply in the cases we are now considering. Should perforation unfortunately occur, the first thing that happens is discharge of the aqueous fluid, with obliteration of the anterior chamber; the lens then comes forward, and with it the iris, which becomes incarcerated in the wound. If the wound is small, only a small piece of the iris becomes adherent to the lips of the wound; it remains in this position until healing occurs, and after the formation of the anterior chamber a permanent anterior synechia remains. If the wound is large, the iris blocks the hole, and healing takes place over the prolapse, and a false cornea is found consisting of iris tissue and remains of the cornea. In this case the anterior chamber practically ceases to exist, and an anterior staphyloma may be formed owing to the bulging forward of this relatively soft scar tissue by the normal intraocular pressure. Small anterior synechiæ can be dealt with later, after healing is complete, though not at the time of perforation; but in the meantime other complications may arise—e.g. secondary glaucoma—so that whenever perforation occurs the case presents additional anxieties for the practitioner. In spite of all this, the treatment described above must never be modified, but carried right through to the end.

After an ulcer has healed, unless it has only involved the surface epithelium, a scar always remains, which is caused by the formation of fibrous tissue laid down in the healing process. This may be dense and white (leucoma), or merely a faint haze (nebula). In both forms the scar interferes considerably with vision, though this depends to some extent on its position. The scar is covered by normal epithelium, so that the surface is quite smooth.

Some of the commoner types of corneal ulcers usually met with in general practice will now be considered, and the special line of treatment applicable in each case indicated, but only as an addition to the measures emphasized above.

Phlyctenular ulcers (Plate 2, Fig. 5) may occur on any part of the cornea, though they generally spread from the limbus as a complication of phlyctenular conjunctivitis ; but they may also appear as single or multiple ulcers in many different places. They are seen mostly in children living in unhealthy surroundings, and are not, therefore, so common in private as in hospital practice.

They cause intense pain, watery discharge, and photophobia, and the photophobia is often so intense that the child keeps the lids tightly closed and resists all efforts made to open them. On this account the skin of the lids becomes excoriated, and cracks appear at the outer canthus which are burst open at every attempt to separate the lids. In spite of all this, a periodical examination of the cornea is essential, and retractors must be used, as any rough manipulation may cause damage to the eye. The condition of the ulcer must be noted, whether it is extending over the surface, or is showing any sign of perforation, and more especially the pupil must be inspected to see whether the atropine is producing full dilatation. Often, owing to the blepharospasm, the atropine is not properly instilled by the parents or friends, and this accounts for delay in the healing of the ulcer and the continuance of the photophobia. Nothing much can be done at the time if perforation occurs, and the treatment need not be changed, but an expert opinion should be obtained as soon as the ulcer has healed, since there is sure to be an anterior synechia to deal with.

One variety of phlyctenular ulcer is the *fascicular ;* this is cone-shaped, with its apex towards the centre of the cornea and its base at the limbus, which carries on

the surface a leash of conjunctival vessels. The advancing point stains with fluorescein, and the special treatment required is to cauterize the advancing edge and also cut off the leash of vessels at their origin at the limbus.

Another variety, the *catarrhal*—so called because it is the result of catarrh of the lids—is of an oval shape and situated on some part of the cornea just inside the limbus (Plate 2, Fig. 6). It may spread all round the cornea if not properly treated, and form a sort of ditch ulcer, so that it is important to understand the cause of this type. In addition to the ordinary treatment of corneal ulceration, the lids may be painted with protargol once or twice a week, and a lotion used containing sulphate of zinc. In the ordinary way, when treating a corneal ulcer, no stimulating or astringent lotion should be used, but in this form the conjunctivitis is the main condition to be attacked, and therefore the effect of such lotions on the cornea must be risked.

Superficial ulcers, i.e. ulcers of the surface epithelium, occur more frequently than is realized, and often escape notice on this account, but they sometimes explain the delay in recovery of what looks like an ordinary conjunctivitis in one eye. Staining with fluorescein and examination with the corneal magnifying lens will often reveal minute punctate, dendritic (Plate 3, Fig. 1), or stellate ulcers. These require special treatment, otherwise they spread over the whole surface of the cornea and eventually may involve Bowman's membrane and the superficial layers of the cornea, thus leaving scars ; but if they are properly treated no scarring results, though they are liable to recur. The special treatment required is to paint the ulcer with pure carbolic acid, which is best done by an expert.

Hypopyon ulcer, or **Ulcus serpens** (Plate 3, Fig. 2), is one of the most dangerous types of ocular ulcer, and may be met with in private practice. The organism which

Fig 1 —Dendritic ulcer (stained green).

Fig. 2.—Hypopyon ulcer.

Fig. 3.—Interstitial keratitis.

Fig. 4 —Corneal nebulæ

Fig. 5.—Arcus senilis.

Fig. 6.—Episcleritis.

PLATE 3.

gives rise to it is the pneumococcus, which may gain access to the eye as a result of trauma produced by infected foreign bodies, or through the lacrymal passages, especially in cases where there is pre-existing suppuration in the lacrymal sac ; and excision of the sac has often to be performed before the corneal ulcer itself can be dealt with. It quickly leads to destruction of the eye, but in the earlier stages the hypopyon is often so small that it has to be definitely looked for, and, except for the first day or two, there is extraordinary freedom from pain. Since pain is the usual accompaniment of corneal ulcers, its absence is a bad sign and indicates rapid destruction of the nerve-endings of the cornea. Pain sometimes returns in the later stages ; this means that increased tension has supervened, a common complication of hypopyon ulcer ; but the cause of this pain must not be overlooked or attributed to an exacerbation of the ulceration itself, otherwise the wrong treatment will be applied at what is a critical stage.

The proper **treatment** is to cauterize the ulcer freely with the actual cautery, or paint it with pure carbolic ; and of the two methods I distinctly prefer the former, since the latter does not destroy deeply enough.

The presence of pus in the anterior chamber is apt to be regarded by the practitioner in the same light as pus in any other cavity in the body, and his general inclination is towards getting rid of it. This view is entirely wrong. In the first place, the hypopyon is sterile and caused by an intense iritis produced by toxins dissolved in the aqueous and derived from the growth of organisms (pneumococci) on the surface of the ulcer; and if these organisms are destroyed, as they are by the actual cautery, the hypopyon will be readily absorbed. With the idea of promoting absorption or discharge of the pus, and possibly for relief of pain—which, however, is generally absent unless rise of tension occurs—the practitioner often applies hot fomentations as he would in other parts of the body.

These fomentations are tied on and the lids are kept closed, and thus a suitable nidus for the growth of the organisms is formed; moreover, the epithelium is sodden, and readily breaks down, so that the ulcerated surface is increased. There seems to be no more reason for tying up and keeping warm an eye with hypopyon ulcer than an eye affected with ophthalmia neonatorum or purulent conjunctivitis. These affections are all due to virulent organisms which endanger the cornea; and it is not necessary to evacuate the pus, even if we could. Personally, I treat hypopyon ulcers in exactly the same way as ulcers caused by gonorrhœal conjunctivitis, except for the use of the cautery.

The eye must be washed out frequently with perchloride-of-mercury (1 : 7,000) lotion, hydrogen peroxide, or quinine lotion (3 gr. to the ounce), and kept uncovered except for a shade or shield.

Many complications arise in the course of a hypopyon ulcer, but these require an expert opinion, which should be sought without delay if the ulcer shows no tendency to heal and the hypopyon remains unabsorbed.

I have already alluded to ulcers of the cornea *secondary to gonorrhœal conjunctivitis and ophthalmia neonatorum*, which are extremely liable to perforate. They must be treated in exactly the same way as any other corneal ulcer, but the treatment of the lids must be the chief concern, since upon their condition depends the ultimate recovery of the cornea.

Ulcers due to *diphtheritic conjunctivitis* and *trachoma* are similar to those occurring in ophthalmia neonatorum; they start in rather different ways, but the healing and resulting scars depend entirely upon arresting the inflammation in the lids. These ulcers are seldom seen in private practice, as also are those met with in *keratitis due to exposure from failure in closure of the lids*, and in *neuro-paralytic keratitis*. All these ulcers, in addition to the ordinary

methods, call for special treatment, viz. an operation for partially suturing the lids together in order to lessen the size of the palpebral aperture; but for this operation an expert's services are desirable.

Severe and rapid ulceration and destruction of the cornea may occur in marasmic children, when the whole cornea may slough away. As soon as improvement in the general health begins to show itself as a result of proper nutrition, the cornea immediately responds to the usual local remedies.

Interstitial keratitis (Plate 3, Fig. 3), an inflammation starting in the deeper layers of the cornea, usually but by no means invariably due to congenital syphilis, is almost always an alarming condition for the general practitioner to deal with. In its typical form syphilitic keratitis starts generally between the ages of five and fifteen as an intense and deep vascularization of the cornea with inflammatory exudation in the upper or lower quadrant, or both, at the limbus, and rapidly covers the whole of the cornea; it gives rise to a pinkish-white infiltration, known as the "salmon patch," which effectually obstructs all light, and the patient is to all intents and purposes blind. There is never any superficial ulceration, and therefore no staining with fluorescein. After an interval of a few weeks or months the other eye, as a rule, is affected similarly, so that the patient is unable to see anything and has to be led about. In addition to these clinical signs there is often intense photophobia, which is rather uncommon in corneal conditions when the surface epithelium is intact.

A vigorous and perfectly correct line of treatment seldom has any influence in checking the process up to this point, and the appearance of the eye and the effect on the sight are so alarming to the patient and his friends that the general practitioner finds some difficulty in allaying their anxiety regarding the ultimate prognosis.

Treatment.—Bathing the closed eyes with water as hot as can be borne, the occasional application of leeches to the temple, the instillation of atropine, the exclusion of light by means of dark glasses, and the administration of tonics are the treatment to be carried out in order to avoid the complications that often arise in the course of this disease. Antisyphilitic remedies should be tried, though the results are very variable ; otherwise the cure is largely a matter of time. When this takes place the cornea gradually clears up from the periphery towards the centre ; and it is characteristic of syphilitic keratitis that, considering the apparently serious straits to which the eye has been reduced, the recovery may be so complete that the ultimate damage to the sight is surprisingly small, the vision finally being little, if at all, below normal. With this knowledge the general practitioner will be able to encourage the patient during the acute stage of the disease.

Keratitis profunda is the name used to designate a form of interstitial keratitis which is caused by some disordered state of the blood, often toxic in origin. It has the same pathology as the congenital specific variety, but the clinical features are somewhat different. There is much less vascularity in the corneal infiltration, which may start in any part of the cornea as an isolated patch ; there are often no vessels at all, and not even ciliary injection, which is virtually always found in other corneal inflammations. The keratitis is generally confined to one eye, and often takes a long time to clear up. In addition to the ordinary local treatment, attention must be directed to the general health, which is always at fault.

Sclerosing keratitis, as its name implies, starts in the sclera and spreads on to the cornea and into the deeper layers ; its causes are similar to those of keratitis profunda, and the treatment is conducted on similar lines.

Nebulæ on the cornea (Plate 3, Fig. 4), the result of ulcers, almost always interfere with the vision in a greater

or less degree; but it must not be assumed that *all* the defect in vision is due to the nebulæ. After prolonged corneal ulceration many eyes become myopic, due to lengthening of the eyeball as in any other case of myopia. This is perhaps the result of involvement of the sclera in the inflammatory process, but the fact remains that in old cases of corneal ulcer the vision is often considerably improved by means of concave glasses, and these should always be tried before a definite opinion is given regarding the amount of damage to the sight. Stenopœic lenses also often conduce to better vision. Massage of the eyes, after the introduction of yellow oxide of mercury and the instillation of 3–10 per cent. dionine, is useful in promoting the absorption of corneal nebulæ.

A few other corneal conditions about which a practitioner's opinion may be asked must now be considered.

Arcus senilis is a crescentic grey line commencing in the upper and lower quadrants near the limbus, but always separated from it by a clear margin of healthy cornea (Plate 3, Fig. 5). The opacity, which is a fatty degeneration, often extends round the whole circumference of the cornea, and occurs usually in old people, but is occasionally met with in young or middle life. The infiltration has no practical significance; it never spreads over the centre, nor does it indicate any special weakness of the corneal tissue. Patients fear that it is a cataract, and come for advice thinking that it will spread over the whole cornea and affect the sight. They may be confidently assured that this never happens.

Lead deposit on the cornea is hardly ever seen at the present day when lead lotions are seldom used in eye affections; they should never be used in cases where the epithelium is denuded, as in abrasions or ulcers, and indeed lead should be entirely excluded from ocular therapeutics. If lead lotion has been used in an abrasion the lead will be deposited on the abraded surface and appear

as a bright shining white area not unlike a leucoma. It can be diagnosed from leucoma by the sharply defined boundary that marks it off from the rest of the cornea, which is healthy. Any corneal inflammation which could give rise to a scar of such pearly whiteness would certainly have been a very severe and extensive ulcer in the acute stage, and would have an irregular, ill-defined border, the remains of the old outlying infiltration surrounding the original ulcer.

Degeneration bands of opacity on the cornea are sometimes seen which look much like an ordinary nebula but under the microscope show many spots of shiny degenerated material in the midst of the infiltration. They are generally not capable of absorption, and can only be dealt with surgically, though often not very successfully.

Conical cornea is very rare, and occurs in adults. It is caused by softening of the centre of the cornea, with subsequent bulging under the influence of the normal intraocular pressure. It causes headaches and eyeache, especially after reading and sewing, and the vision is often seriously affected. It is difficult to treat ; but the sight can sometimes be improved by wearing very high cylinders, if the patient can get used to them. In addition, various surgical methods have been devised for arresting the bulging ; but as to these an expert opinion is essential.

2. Inflammations of the Sclera

Inflammations of the sclera are known as **episcleritis** and **scleritis** (Plate 3, Fig. 6, and Plate 4, Fig. 1). The former is only an early stage of the latter ; there is no essential difference between the two, and whether the one term or the other is used depends upon the degree of the inflammatory process. The inflammation manifests itself in a typical form as a dark purplish-red localized patch 2–3 mm. from the limbus, often nodular in character, and fixed to the globe, with the conjunctiva freely movable

over it. There is not much pain, though the affected area is tender to the touch, both eyes are often involved, and the condition lasts for many weeks or even months.

Even by the most experienced, inflammation of the sclera is viewed with misgivings, since it runs a chronic course and displays an obstinate indifference to various lines of treatment. The only difficulty for the general practitioner is to diagnose it correctly, and thus not regard too lightly early manifestations which may appear to be of a trivial nature. The localized inflammation near the limbus renders it liable to be mistaken for an ordinary phlyctenule; it is distinguished from the latter by its more purplish hue, its chronic course, and its occurrence in adults much more often than in children. It may be said therefore that when in an adult an inflammatory patch appears at the limbus which looks like a phlyctenule, one should always suspect episcleritis, and be guarded in giving an opinion.

The **causes** of episcleritis are syphilis, tubercle, or some other microbic disease, and toxic absorption from any septic focus. Careful investigation is required to discover the locality of the septic focus, and success is often very imperfect.

The **complications** of scleritis may be inflammation of the iris and ciliary body. It is therefore a potentially serious affection, which demands careful treatment in the early stages.

Treatment.—So-called chronic rheumatism is said to be associated with this condition, and for this reason salicylates, aspirin, etc., often do good, but in any case attention to the general health forms the main basis of successful treatment. The local remedies must be atropine twice daily, dionine drops (3–5 per cent.) every other day, massage with some simple or stimulating ointment, an occasional application of leeches to the temple, and protection from bright light by wearing appropriate glasses.

CHAPTER IX

IRITIS AND CYCLITIS

INFLAMMATIONS of the iris and ciliary body can scarcely be dissociated from each other, since they are so closely connected anatomically that inflammation in one readily spreads to the other, and both are generally involved at the same time. It is possible, however, that iritis may exist without cyclitis, but cyclitis practically never occurs without more or less iritis.

The practitioner must thoroughly understand and recognize the signs and symptoms of inflammations of the iris and ciliary body. Some of them are very insidious in their onset and course. The more typical cases can be easily diagnosed, and he must continually keep in mind the fact that unless promptly treated, both may quickly lead to a condition of secondary glaucoma and cause other complications which result in total loss of vision.

1. IRITIS (Plate 4, Fig. 2)

The iris is a diaphragm composed of loose spongy stroma in which are contained nerve-fibres, blood-vessels, muscular tissue, and pigment, lined on its posterior surface with two layers of cells both containing pigment.

If we now apply our knowledge of the pathology of inflammation to this structure, we can easily realize what the effect on the iritic tissue must be.

Albuminous exudate into the stroma with dilatation of the blood-vessels leads to—

(1) *Fixed contracted pupil* from swelling of the iris, together with some adhesion to the anterior capsule of the lens upon which the iris rests.

Fig. 1.—Scleritis.

Fig. 2.—Iritis.

Fig. 3.—Ciliary or circumcorneal injection.

Fig. 4.—Cyclitis.

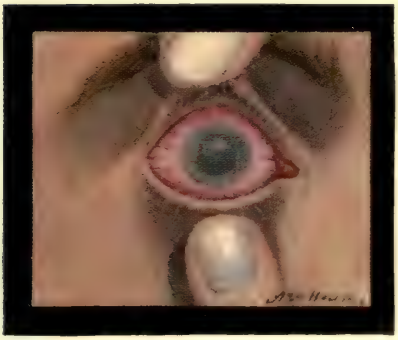

Fig. 5.—Glaucoma.

Fig. 6.—Lens opacities.

PLATE 4.

(2) *Discoloration* (the so-called muddiness) of the iris with *loss of pattern.*

(3) Exudation into and *opalescence of the aqueous humour.*

(4) *Circumcorneal or ciliary injection* (Plate 4, Fig. 3), due to dilatation of the deep ciliary vessels round the limbus, from which the vessels of the iris arise.

(5) *Pain,* often intense and radiating over the side of the head and brow, especially at night, when all inflammatory pain is most acute.

(6) Some *lowering of visual acuity* of varying extent.

In some cases there is pus in the anterior chamber (hypopyon), due to excessive leucocytic exudation from the blood-vessels, and occasionally there is blood in the same position (hyphæmia), but both these signs are rare and must not be expected in ordinary iritis.

Tension is normal, or slightly reduced, except when there are complications.

The practitioner cannot too often contrast these points with those to be described under the head of glaucoma, for which iritis is commonly mistaken. It is a mistake attended by the most serious consequences, since the treatment for the one is exactly the opposite of that for the other.

In addition to this acute inflammatory type, there is the chronic form, which is slower and more insidious in its onset and moreover involves the ciliary body. There is not much pain, and perhaps very little ciliary injection, while the aqueous humour remains clear, but the danger of delay in diagnosis and treatment is much greater than in acute iritis. Unless the right diagnosis is made early, there is plenty of time for the formation of adhesions to the anterior capsule of the lens, and for them to become strong and fibrous, before treatment is begun. Before we are really aware of it, the whole of the pupillary border may become bound down, and the condition known as

iris bombé (total posterior annular synechia) be firmly established, with the consequent danger of secondary glaucoma, while the ciliary body is almost sure to be involved. The reason secondary glaucoma occurs with this complication is that the fluid secreted from the ciliary body cannot circulate from the posterior into the anterior chamber between the iris and the lens, and therefore it bulges the iris forward at the periphery and the angle of the anterior chamber becomes blocked; thus even the small amount of fluid that may possibly get through the iris tissue cannot drain away through the spaces of Fontana, and the ocular tension rises.

Special forms of iritis are sometimes encountered, with nodular enlargement either at the pupillary border or at the periphery of the iris, in addition to the signs and symptoms already described. Such forms occur in late secondary syphilis and in tubercle.

When a patient has once had iritis, from whatever cause, he is very liable to recurrent attacks as a result of any form of toxæmia. He must therefore be warned against neglecting any attack of redness of the eye, however trivial it may appear to be.

Old iritis may be diagnosed by the presence of spots of pigment on the anterior capsule of the lens, being the remains of pigment torn off the posterior layers of the iris after the adhesions have been broken down, and again by the irregular shape of the pupil when dilated, due to the attachment to the anterior capsule of the lens of parts of the pupillary border which cannot be broken down under atropine. It is possible for patients to have recovered from iritis without knowing that they have had an attack, so that these facts are of importance when a patient comes to be examined for the first time.

Etiology.—The causes of iritis are many, but perhaps the commonest is gonorrhœa. The gonococci appear to be capable of remaining latent for many years in the

recesses of the urethra and the glands connected with it, and may at any time give rise to a recurrent attack. Other causes are syphilis, tubercle, rheumatism (chronic, but not acute), gout, organisms from teeth and various mucous membranes, including the intestinal tract; and all such sources of infection must be carefully investigated before any satisfactory general treatment can be undertaken.

Treatment.—This must be both local and general, and the latter is perhaps more successful than in many other inflammatory conditions of the eye.

Local applications include hot bathing of the outside of the eye with closed lids, and the installation of atropine (1 per cent.), which must be pushed until some parts or the whole of the circumference of the pupil become as fully dilated as possible; they must be kept in this state for several weeks after all signs of inflammatory reaction have passed off, *no matter what complications may ensue.* The other local measures are the application of leeches or blisters to the temple if the pain is severe and the iris does not show signs of yielding readily to the action of atropine; and protection from light by wearing dark glasses. *Do not be afraid of using atropine, even though there may be increased tension:* even in this event it is still the right treatment to adopt. In iris bombé, atropine should be used in greater strength than ever in the hope, which is generally fulfilled, of breaking down some of the weaker adhesions and establishing even a slight connexion between the anterior and the posterior chamber.

The **general treatment** should be directed towards counteracting the toxins which are derived from remote parts of the body, and therefore, in addition to tonics, change of air, etc., various injections will be found of great value, e.g. gonococcal vaccines and salvarsan. Failing the discovery of any definite cause, mercury inunctions and hot-air baths are occasionally serviceable.

The question of iridectomy may arise in connexion

with the treatment of iritis, since some patients are aware that this operation is performed, that good results are claimed for it, and that it is reputed to prevent recurrent attacks. If the practitioner's opinion is sought, he will certainly not be justified in advising or performing the operation in cases in which the dilatation of the whole or the greater part of the pupillary border can be secured by the prompt use of atropine. Some experts claim for iridectomy that it lessens the liability to recurrence ; but this advantage is by no means invariably attained, and therefore, in my opinion, the risks attending the operation ought not to be run.

When the whole, or practically the whole, of the pupillary border is bound down to the anterior capsule of the lens, iridectomy should be advised as a prophylactic, so as to avoid the danger of any subsequent attack of iritis closing up the only chink by which the connexion between the posterior and the anterior chamber is maintained ; but the operation should, if possible, be delayed until the eye is quite quiet. When performed during an attack, its effect on the already inflamed tissue often causes the gap made in the iris to be filled up with exudate, and counteracts the benefit that might otherwise be derived from it.

While it is well for the general practitioner to be acquainted with all the points connected with the operation, in order that he may be able to give sound advice, it is not desirable for him to attempt the operation himself. A good deal of technique is essential, and it must be remembered that in most cases the lens is still undamaged and that any lack of skill may easily result in a traumatic cataract. Any cases of iritis which run a prolonged course, in spite of treatment, are probably complicated by involvement of the ciliary body, and a careful examination should be made from time to time to determine whether this is the case or not.

2. Cyclitis

Inflammation of the ciliary body, apart from the signs of accompanying iritis, may be difficult for the general practitioner to detect, since the only visible sign and proof of its existence is the presence of keratitic precipitates (K.P.) on the back of the cornea. (Plate 4, Fig. 4.) These spots, which may be fairly large ("mutton fat") in acute cases, or so small as to be invisible to the naked eye, as is often the case, consist of collections of leucocytes attached to the back of the cornea. In quiet, insidious cases, indeed, they may even elude the careful examination of the most expert, and yet they are of the utmost importance. If these spots are pigmented, they are probably old, and sometimes they are the only evidence of former attacks of cyclitis. The practitioner must lose no opportunity of observing them as often as he can, not only because they constitute the only infallible sign of the presence of cyclitis, but also because the ultimate termination of this affection is always a matter of uncertainty, in spite of the most careful and competent treatment, and vision in an eye so affected may eventually be lost.

Cyclitis may continue for months, or even years, and various complications may develop one after another, and endanger the sight of the eye, causing the practitioner the greatest anxiety. Inflammatory exudate in and around the ciliary body may give rise to a fibrous network in the posterior chamber, as well as to floating opacities and fibrous bands in the vitreous which seriously interfere with vision, and in longstanding cases the ciliary body itself may be transformed into fibrous tissue which contracts and practically destroys the glandular structure of this organ. In these circumstances the secretion of aqueous becomes less and less, and finally ceases altogether. The lens grows cataractous, the vitreous shrinks owing to lack of nutrition, and the retina becomes detached, from

lack of support ; thus the eye gets soft and smaller, and sometimes is very tender. So the vision is destroyed, and the eye may have to be excised.

Cyclitis does not necessarily terminate in this way, but on recovery the lens may be cataractous and the iris may be lighter in colour, owing to absorption of the stroma pigment ; this is one of the causes of difference in the colour of the irides, the lighter one being on the affected side.

The **cause of cyclitis** is a general infection, as in syphilis or tubercle, attacking the ciliary body, or a toxæmia from some remote part of the body. Sympathetic inflammation of the eye is a cyclitis ; it is considered elsewhere (p. 119).

Treatment.—In addition to the treatment for iritis, viz. hot bathing, atropine, and protection with dark glasses, leeches or blisters to the temple should be applied regularly and periodically ; attention to the general health must be directed especially towards any discoverable source of toxæmia, and mercury inunctions and hot-air baths should be given. As the inflammation subsides the hot applications may be discontinued, but the atropine must be persevered with for a long time, much longer than in simple iritis.

Some cases of cyclitis develop increased tension while still in the inflammatory stage, the viscous exudate blocking up the canal of Schlemm, and therefore the anterior chamber is not altered in depth. This may lead the practitioner to doubt whether he should use atropine. Probably atropine does no harm when the anterior chamber is deep, but it certainly does no good, and may be discontinued ; on the other hand, eserine must never be used, as it only increases the dilatation of the blood-vessels and contracts the pupil. A paracentesis (tapping the anterior chamber) is indicated, and in these circumstances may have to be repeated frequently, but the practitioner will be wise to seek advice when this complication arises. Unless relief is afforded the eye will become blind in the same way as in ordinary primary glaucoma.

CHAPTER X

GLAUCOMA

GLAUCOMA is a disease which, more than any other affection of the eye, haunts the mind of the general practitioner; and inevitably so, for in no other ocular disease are rapidity and accuracy of diagnosis so vitally important; and an error of judgment, for which there is little excuse in acute cases, may easily cost the patient his sight.

Strictly speaking, glaucoma is only a symptom of increased intraocular pressure which is generally the result of diminished outflow of fluid associated with normal or increased secretion; but it is accompanied by other signs and symptoms, all of which are due to the hardness of the eye. A disease of adult life, uncommon in children, it is most frequently associated with hypermetropia, though by no means unknown in myopia.

The increased pressure may be caused by previous inflammation of the iris and ciliary body, anterior or posterior synechia, wounds or dislocation of the lens, intraocular tumours, or intraocular hæmorrhage. In these cases it is known as *secondary* glaucoma. But the glaucoma with which we are now concerned is due to the presence of certain associated anatomical defects which interfere in some way with the normal circulation of the aqueous fluid. Various theories are current to account for this **primary glaucoma,** but the one most generally accepted at present is that put forward by Priestley Smith, whose experimental work has established the fact that the lens under normal conditions gradually but slowly increases in size during life, and in small eyes the peripheral border approximates so closely to the ciliary body that

any swelling of the ciliary body which may occur under increased blood supply is likely to bring the two absolutely into contact; in this way the anterior is shut off from the posterior chamber and fluid accumulates in the latter, thus pushing the lens and the iris forwards and blocking the angle of the anterior chamber. It follows that worry, excessive exertion, alcohol, nervous congestion, etc., by increasing the blood-pressure, predispose to glaucoma.

Primary glaucoma may be either acute or chronic. The **acute** form (Plate 4, Fig. 5) comes more under the notice of the general practitioner than the chronic, and the most successful results are obtained if the condition is quickly recognized and immediate operation advised. More often than any other condition it is mistaken for iritis and treated accordingly, with the most disastrous results. Both eyes are sooner or later affected, though one slightly in advance of the other, the interval varying from a few weeks to a few years. The signs and symptoms about to be enumerated must, therefore, be well fixed in the mind, and continually contrasted with those of iritis, already described.

The *symptoms and signs* of acute glaucoma are:

(1) Pain in and over the affected eye confined to the corresponding side of the head, lasting continually during the day as well as the night.

(2) Increased tension, as compared with the opposite eye.

(3) Fixed dilated pupil. Primary acute glaucoma cannot possibly exist with a contracted or an active pupil.

(4) Steamy cornea, due to œdema of the surface epithelium.

(5) Shallow anterior chamber.

(6) Coloured rings round lights.

(7) Occasionally vomiting, owing to the severity of the pain.

(8) Defect of vision, or lowered visual acuity.

(9) Slight ciliary injection due to obstructed blood-vessels at the limbus.

Diagnosis.—It is easy to understand that the pain in the head associated with vomiting may be attributed to a bilious attack, for which, in fact, glaucoma is commonly mistaken. An examination of the eye revealing the signs just enumerated will quickly dispose of this error.

If *all* the symptoms mentioned are compared with those of iritis, the two diseases cannot well be confused. If, however, an error is made, eserine, which is the treatment for glaucoma, makes the iritis worse, and atropine, which is the treatment for iritis, increases the glaucoma.

Glaucoma is sometimes mistaken for cataract, but there is little excuse for this confusion. We have only to carry out the pupil reaction, which is normal in an ordinary cataract and defective in glaucoma, and the examination by reflected light in a dark room, when the normal red reflex is present or only slightly modified in glaucoma but absent in cataract, to attain certainty. Cataract does occur as a secondary complication of glaucoma, but only when the glaucoma has reached a stage at which a mistaken diagnosis is impossible owing to the stony hardness of the eye.

Unless the rise of tension is relieved, the pressure exerted inside the eyeball affects the weakest part of the external coat, viz. the lamina cribrosa, through which the optic nerve-fibres pass from the interior of the globe. This membrane is pushed backwards and the nerve-fibres are pressed upon, so that eventually blindness follows from optic atrophy.

After a time, if no treatment is adopted, the pain ceases entirely, although the hardness of the eyeball remains. Pain is no longer felt because all nerves of sensation are destroyed by the pressure, and if the eye is not causing any trouble, and therefore does not call for excision, the

next stage is the bulging of the eye near the equator which is called a staphyloma.

Treatment consists in the performance of an iridectomy at the earliest possible moment. Eserine drops (½–1 per cent.) instilled into the eye frequently reduce the tension, and this is the only legitimate form of temporizing, which must be carried out regularly until preparations for the operation can be completed. I am much in favour of steps being taken to reduce the general blood-pressure prior to an operation; they often result in temporary reduction of tension by relieving the pressure on the blood-vessels in the eyeball, thus lessening the danger of intra-ocular hæmorrhage after the operation.

The patient should be put to bed at once, hot bathing applied to the eye, eserine drops instilled every hour, a calomel purge given, leeches applied to the temple, and morphia injected to ensure a good night's rest, perhaps the first for several nights.

These preliminary measures often make an otherwise very difficult operation a good deal simpler, though never one to be lightly undertaken, and the patient, who is usually of a highly-strung disposition, faces the operation with far more composure than when in a state of acute pain associated with nerve tension following sleepless nights.

Although this is one of the cases in which an immediate operation is imperative, I cannot think it advisable for the general practitioner to perform it himself. It is one of the most difficult and delicate operations in ophthalmic surgery, and it is not to be expected that the points in the technique which are essential to success should be appreciated by those unaccustomed to it; there is also the risk of accidents, e.g. penetration of the capsule of the lens, which is generally clear; such accidents may make the operation a complete failure so far as binocular vision is concerned.

A general anæsthetic is necessary, since a glaucoma iridectomy, if properly performed, is a painful operation.

Chronic glaucoma is a less urgent condition, and a policy of temporizing is not attended by such serious consequences, but on the other hand it is more difficult to diagnose, and is very insidious in its onset, owing to absence of the leading signs which characterize the acute form. Indeed, the eye may appear perfectly normal, at any rate externally, when a patient with chronic glaucoma presents himself for examination, and frequently the condition is discovered entirely by accident in the routine examination for refractive errors.

Often the only *history* obtainable is one of periodical attacks of " neuralgic pain " over the eye, and sometimes coloured haloes round lights in the evening, with a certain amount of diminution in visual acuity. Some increased tension would be noted if the patient could be seen when these symptoms are present, and efforts must be made to secure his attendance during an attack. All the signs of an acute glaucoma, though in a modified form, would then be noticed.

In addition to the history of these periodical attacks of pain and mistiness, there are *signs* that can only be elicited on examination, viz. :

(1) Failure of the pupil to maintain contraction when light is thrown on the eye by oblique illumination, or perhaps a slight permanent enlargement compared with the other eye.

(2) Cupping of the optic disc.

(3) Contraction of the visual field in some part of the periphery, more commonly on the nasal side.

(4) Enlargement of the blind spot.

The first of these phenomena is common to other conditions as well as glaucoma, so that the test has only a relative value ; the second is often not typical, and can only be verified by one who is thoroughly experienced in

ophthalmoscopic examination ; the third and fourth must be accurately charted on a perimeter, and in the early stages can only be demonstrated as having importance by special types of perimeter which the practitioner is not likely to possess.

Treatment.—The diagnosis of chronic glaucoma once made, eserine (½ per cent.) must be instilled regularly twice a day, and attention paid to the general health to prevent any rise of blood-pressure. These cases are liable at any time to develop an acute attack, and in my opinion generally require an operation ; and the earlier this is performed the better the results. Iridectomy, which is the operation for acute glaucoma, has not proved entirely satisfactory for the chronic form, and the aim of all the many ingenious operations that have been devised in lieu of it is to ensure an efficient drainage from the anterior chamber by establishing a filtering scar. Trephining at the limbus beneath a conjunctival flap is the one which appears to give the most satisfactory results, and it is almost universally adopted.

When glaucoma has attacked one eye it is almost certain that the other will be affected sooner or later ; and the patient must be carefully examined at intervals of a few months, so that any early signs may at once be noted.

CHAPTER XI

DISEASES OF THE LENS AND THE VITREOUS

1. Diseases of the Lens

The lens is an epithelial structure enclosed in a capsule; it contains no blood-vessels, and therefore can never be the subject of inflammatory reaction. All changes in the lens leading to loss of transparency are due to degenerative processes, which cause fluid to accumulate between the fibres, with ultimate formation of albuminous deposit in the liquid—the cause of the opacity (Plate 4, Fig. 6).

Cataracts are divided into different types according to their position (or the extent of the opacity), but the commonest form is the *senile*, which seldom occurs in patients under 50 years of age. It begins as spots or spokes of opacity in the peripheral cortex of the lens, and after a variable time extends all over the lens substance; when the centre part is involved, vision becomes obstructed and the sight begins to fail, eventually being lost altogether. The centre or nucleus of the lens is contained in the midst of this opaque degenerated material.

The commonest type of cataract in *infants and children* is the lamellar, in which the opacity is situated in the layers surrounding the nucleus but does not extend quite up to the periphery of the lens, thus leaving beyond the opacity a small clear area, which, however, is generally covered by the iris, and is of no value for visual purposes. It is associated with hypoplasia of the teeth, pointing to the fact that both are due to malnutrition early in infantile life or in a prenatal stage.

Other types are secondary cataracts, due to inflammatory changes in the ciliary body, detached retina, and pigmentary

degeneration of the retina, the opacity in such cases commencing in the posterior cortex; traumatic, anterior and posterior polar cataracts, and congenital cataracts other than lamellar.

The **symptoms** of cataract are spots in front of the eyes, multiple images (polycoria), dimness of vision, distant and near, coming on gradually, and worse in a bright light when the opacity is central. As a rule, dull light is preferred to bright light in most cases of cataract, as the pupil dilates and allows more light to enter the eye.

In order to make a **diagnosis** of lens opacities and of the extent to which they affect the vision, a careful examination must be made in one or two different ways, applicable to any age. Considering how simple these methods are, it is strange that mistakes should frequently be made.

First, it is important to record the actual vision in terms of Snellen's test-types, counting fingers, hand movements, or perception of light, according to the density of the cataract. The pupil reaction must be carefully noted. Remember that, provided there is no other disease in the eye and the retina is healthy, no cataract at any stage is dense enough to exclude sufficient light to invalidate this test, the pupil reaction in cataract behaving exactly the same as when the eye is normal. If the pupil reaction is not normal, there are probably other changes in the eye of so serious a nature as to militate against the success of any operation.

Next, unless there is any contraindication, dilate the pupil with homatropine and cocaine, and ascertain the full extent of the opacity by means of reflected light from an ophthalmoscope mirror held up to the observer's eye at a distance of 1 or 2 metres (*see* p. 19). Any opacities will be shown up as black marks, dots, or streaks against the normal red reflex of the fundus. Such opacities are common in the senile variety; the lamellar type shows as a central circular black opacity with a clear area round

the margin. No reflex at all means that the whole lens is opaque Never express any positive opinion on a cataract until this method has been carried out. Many lenses in old people show a marked grey reflex to oblique illumination and yet are perfectly transparent by reflected light ; this may easily be mistaken for a cataract, but the supposed opacity is merely a reflection from the sclerosed nucleus. There is nothing easier than to commit oneself to a hasty diagnosis by examination in daylight or by oblique illumination alone.

The diagnosis from glaucoma has already been given (p. 97).

If a cataract is completely mature there is no red reflex from any portion of the fundus, and in this case it is often quite obvious, under examination in ordinary daylight, as a white opaque substance behind the pupil, while oblique illumination fails to " throw a shadow of the iris on the lens." This test, which figures so largely in the textbooks, only tells us that, all other conditions being favourable, the eye under examination is fit for operation, and that the lens can be extracted at any time ; but this is a very small point in deciding on the advisability of an operation, and it is better for the practitioner never to hazard an opinion as to whether a cataract can be successfully operated upon or not ; the test, therefore, is of only relative value. Unless the opacity actually interferes seriously with the sight, it is better to avoid the use of the term " cataract," which often frightens patients unnecessarily and conveys to them the impression of incurable blindness, in spite of the fact that it can be proved to them that there is sight in the affected eye behind the cataract, even when mature, and that an operation can be performed to restore the vision. If the patient *must* be informed about his condition, either because of a direct question or for any other reason, try to explain that there are some forms of cataract which interfere with the sight, while others do not owing to the

opacity being behind the iris when contracted; and it is worth while to try to explain what a cataract really means, since otherwise the knowledge that it exists may have a very depressing effect.

Another question which the practitioner is sure to be asked is how long it will be before an incipient cataract becomes ripe. No positive answer ought ever to be given to this question, as the rate of progress towards maturity varies greatly according to the variety of the cataract, and some of them never become complete.

The **treatment** consists in performing an operation, either that of needling in patients under thirty or extraction in patients over that age. The question of immediate operation turns on so many other points besides that of the density of the opacity that this sign is relegated to a comparatively minor position. Such points are: (1) The original cause of the cataract, whether secondary or otherwise, and, if the former, whether there is any K.P. in the affected eye, evidencing old cyclitis; if so, an operation might not be attended with the customary favourable results. (2) The condition of the unaffected eye as regards vision, etc.; a patient with $\frac{6}{18}$ or $\frac{6}{12}$ vision in the better eye will always prefer to use such an eye which still retains the power of accommodation rather than an eye that has been operated upon and only commands a $\frac{6}{6}$ vision with the aid of a high convex lens. (3) The extent to which work or modes of life are interfered with. (4) The general conditions of health, e.g. cough, albuminuria, diabetes, extreme old age. (5) The condition of the fundus in the affected eye.

As a rule, an operation for cataract is not immediately urgent except when it occurs in very early or infantile life in both eyes, when the sooner it is dealt with the better, so that the functions of the retina may develop as soon as possible. Since many cataracts take several years to become mature enough to interfere seriously with vision,

various plans may be adopted to make the eye as useful as possible during the interval. Such methods are the continual use of weak atropine or of dark glasses, both of which cause a certain amount of dilatation of the pupil and thus allow more light to enter the eye ; in many instances these methods greatly improve the sight. The latter is the more preferable.

Many patients are content to see indifferently in the distance, but find the time hang heavily if they cannot read. This difficulty can often be overcome by giving strong convex glasses ($+6$ or $+7$ sphere) which produce a magnified image. Since it is necessary in these circumstances to hold the print close to the eye, the inevitable strain on the convergence, which would otherwise be unbearable, can be relieved by the use of prisms with their base inwards.

By such temporary measures as these the inconvenience of the waiting period may be much lessened.

A common question asked by patients who have incipient cataract is how far the progression towards maturity is influenced by the use of the eyes ; they want to know how much reading they may do and whether it will be harmful, and also whether they can do anything to prevent the cataract from developing. I do not think the use of the eyes has any effect one way or the other ; it is far better to allow the patient to go on as usual, and, so long as he is able to read with any form of glasses, to make no radical change in his mode of life. The popular notion that the use of a magnifying glass under these conditions is harmful has no foundation whatever. Further, there is no trustworthy method of retarding the progress of cataract.

Dislocation of the lens may be the result of a blow which ruptures the suspensory ligament, either entirely or partially, so that, having no proper support, it is displaced into the vitreous, either directly backwards or into

the lower part of the eyeball. The signs of dislocation are increased depth of the anterior chamber and tremulous iris owing to lack of its posterior support. The lens can sometimes be seen moving up and down in the vitreous by reflected light. Frequently in cases of dislocation the tension is raised, which is a dangerous complication and one very difficult to deal with.

2. Diseases of the Vitreous

The vitreous, like the lens, cannot be the subject of inflammation, since it also is a non-vascular structure. All changes in it are degenerative, or are due to albuminous exudates thrown out from neighbouring parts which do contain blood-vessels, e.g. the ciliary body and the choroid.

Diseases of the vitreous manifest themselves in two forms, one consisting of all kinds of vitreous opacities, e.g. black specks, threads, fine dust-like membranes, or coarser deposits, the other in a shrinking of the vitreous.

Opacities are a source of considerable inconvenience and worry to the patient. Some are so small that they escape observation entirely, even after the most careful examination with the ophthalmoscope, while others are so clearly outlined in the field of vision that the patient can draw them and accurately define their shape. The larger ones indicate (*a*) past or present inflammation of the choroid and ciliary body, or (*b*) relatively small hæmorrhages from the retinal vessels ; they are also fairly common in myopia, in which the vitreous is very often fluid. Large hæmorrhages sometimes take place into the vitreous, the blood being poured out from a ruptured retinal vessel, and although some of them remain localized between the internal limiting membrane and the hyaloid capsule of the vitreous (when they are called subhyaloid), others

burst through the latter membrane and fill the greater part of the vitreous cavity. The retinal vessels are found to be diseased as soon as it becomes possible to obtain a view of the fundus.

Opacities of moderate size are easily observed by direct ophthalmoscopy, and are rendered visible by using a plain mirror in a dull light with a magnifying lens of + 8 D to + 10 D behind the sight-hole.

The small opacities which are practically invisible with the ophthalmoscope are not of much importance, and the patient should be encouraged to ignore them, which he will succeed in doing in time if once convinced that they do not endanger sight. The fairly large ones that can be seen may be due to cyclitis (old or recent), or to inflammation of the choroid. The presence of K.P., as we have seen, is an indication of former cyclitis ; and any raised, white, œdematous inflammatory patches in the choroid (for it is only in the early stages of choroiditis that these opacities occur) are visible as a white reflex from some part of the fundus.

In a severe vitreous hæmorrhage with blood filling the whole of the interior of the eyeball, no red reflex (*see* p. 19) is seen from the fundus, and no details are visible, but the projection of light is good everywhere, since no damage has been done to the rod-and-cone layer of the retina.

Absence of the red reflex in these cases, coupled with good projection, may simulate cataract, but a cataract which is dense enough to shut out all the red reflex can be seen with the naked eye, unless it happens to be a " black cataract," which, however, is very rare.

The **treatment** of vitreous opacities is rather unsatisfactory. Iodide of mercury is supposed to promote absorption, and subconjunctival injections of normal saline, or of cyanide of mercury, have been considered of some value, but the results are very uncertain. At the best,

absorption is very slow, for the reason that the vitreous contains no blood-vessels.

In any disease of the vitreous a consulting opinion is advisable, though so little can be done for it.

Shrinking of the vitreous occurs after longstanding irido-cyclitis (*see* p. 93), and the lowered tension of the eyeball is the first sign that this sequela has begun. It is followed by detachment of the retina and subsequently by absolute blindness. No treatment is of any avail.

CHAPTER XII

OCULAR INJURIES

A GENERAL practitioner may be called upon at a moment's notice to deal with almost any injury of the eye, from a foreign body under the upper lid to a perforating wound with all its possible complications. Such cases are urgent, and the patient, and more especially his friends, are so over-anxious and alarmed that they never consider the question of calling in expert advice, but hurry off immediately to their medical man. He must, therefore, be perfectly familiar with the diagnosis and treatment of the most complicated as well as the simplest injuries, so that he may give proper advice, for in these circumstances a hasty and possibly ill-considered opinion makes a lasting impression which it may be difficult to eradicate or modify.

The general practitioner may prefer not to treat these cases himself, but he should be very clear as to the diagnosis, complications, and modes of procedure, and I propose, therefore, to enter rather fully into the different kinds of injuries.

The commonest injuries are **foreign bodies under the upper lid or on the cornea,** and **corneal abrasions,** and these can be easily and successfully treated without any very expert knowledge. It is useful to remember that foreign bodies, dust, coal, etc., under the upper lid generally produce much more pain, redness of the eye, and lacrymation than those embedded in the cornea, which are often tolerated for several days without much discomfort; the reason being that the foreign body under the lid scratches over the sensitive nerve-endings of the cornea, whereas flying bits of steel either settle in the

cornea beyond the nerve-endings or, owing to their heat, have destroyed them. Roughly speaking, the more severe the injury to the eye the less is pain complained of. Never disregard the history of a foreign body until a most careful search has been made in every place where it is likely to be hidden. Those embedded in the cornea often require the use of the magnifying lens to discover their position, and slight localized vascularity at the limbus and contracted pupil on the affected side are valuable guides to the position. Sometimes quite large ones are caught up in the folds of the upper or lower fornix and cause surprisingly little trouble.

Treatment.—To remove foreign bodies from beneath the *upper lid*, this must be everted (*see* p. 6). The removal of the foreign body is then perfectly simple, and can be effected with any suitable material, such as a wisp of cotton-wool or a piece of lint.

To remove a foreign body from the *cornea* requires a good deal more dexterity than at first sight appears. Its position having been localized, the two things to bear in mind are to disturb the epithelium as little as possible, either at the site of the foreign body or in the surrounding parts, and to remove all vestige of stain or rust at the same time. The new epithelium, although very quickly regenerated, is never so firmly attached or so healthy as the original uninjured layer, and it may easily be detached again at some future time by a scratch too slight to disturb normal epithelium, such as rubbing the eye with a speck of dust in it. This fact obviously affects the prognosis, and one of the commonest troubles in these cases is a recurrent abrasion.

Unless a foreign body is deeply embedded in the cornea, it can often be removed by a wisp of cotton-wool or a stiff piece of card which hardly disturbs the epithelium at all. If this fails, a spud or a needle must be used, and in order to avoid scraping off more epithelium than is necessary

I advocate the invariable use of the corneal magnifying lens. At first it may increase the difficulties, until we become familiar with the magnification of the instruments we are using, but with this help all rust stains can be removed at the same time by careful scraping, and thus the subsequent irritation or infection of the cornea can be best averted. Complete cocainization of the cornea (2–3 per cent.) is essential before any of these methods are employed. In all cases the eye must be tied up afterwards for twenty-four hours, and a drop of atropine (1 per cent.) is instilled in order to keep it quiet for a few days while the epithelium is renewed.

In *corneal abrasions* it is not always easy at first to locate the area of disturbance of the epithelium, although the pain and redness of the eye may be intense; but a drop of fluorescein will immediately disclose its position, when all that is necessary is to tie up the eye with a pad and bandage and keep it closed for twenty-four hours, after instilling a drop of atropine to promote healing. The patient should be warned that the atropine will dilate the pupil and cause temporary mistiness of sight, otherwise he may be alarmed and attribute the defective sight to the results of the accident. When the corneal epithelium is denuded, a guarded prognosis must always be given, for the reason mentioned in connexion with foreign bodies on the cornea; and one must never be led by the rapidity of healing into giving a too optimistic forecast in respect of recurrence.

Sometimes foreign bodies and abrasions are infected, though this is not so common with pieces of metal as with other kinds of foreign bodies, since the former are generally aseptic. Unhealthy conditions of the conjunctiva and lacrymal passages also predispose to infection, and hypopyon ulcer or even panophthalmitis may result.

Small foreign bodies sometimes get embedded in the conjunctiva; they do not cause any special symptoms,

as the conjunctiva is not nearly so sensitive as the cornea. The best way to remove them is to grasp with forceps the piece of conjunctiva enclosing the foreign body and excise the piece of tissue in which it is contained. This is much more satisfactory than attempts at removal with a needle, which invariably result in opening a conjunctival vessel and thus causing a large subconjunctival ecchymosis, which obscures the foreign body altogether. The small piece of conjunctiva is never missed, and it readily heals up without any necessity for a stitch.

Burns of the conjunctiva and cornea occur from hot fluids, metals, chemicals such as acids and alkalis, lime, ammonia, etc. Some of these do more damage than others, alkalis, for example, being more injurious than acids, and lime and ammonia often causing very serious damage. When the conjunctiva is burnt the tissue looks white and œdematous, and there is no dilatation of blood-vessels as in ordinary inflammations, since they are usually destroyed. In the healing process there is danger of adhesions forming between the palpebral and ocular conjunctiva (symblepharon), but this can be prevented by passing a glass rod smeared with some non-irritating ointment between the lid and the globe every day, in order to break down adhesions as soon as they are formed, while still small and thin, and eventually healing takes place without any contraction of the fornix.

As regards **treatment,** the cases are generally seen too late for neutralizing lotions to have much effect, since the damage has already been done. The best thing to do is to keep the parts thoroughly cleansed with some form of *non-irritating* lotion or even sterilized water; in severe cases cold compresses for a short time are useful. In lime burns the particles of lime must be picked off piecemeal under cocaine, often a laborious process.

The most important point to decide is how far the cornea is implicated, and to judge of the extent of any such injury

fluorescein must be used. The case must then be treated like any other form of corneal abrasion or ulceration, except that the lotion used must be the simplest one possible. Provided no infection takes place, healing is often quicker than one might expect.

Contusions of the eye with a blunt instrument cause corneal abrasions and bruising of the tissues, and it is sometimes impossible to discover the extent of the damage when the case is first seen, owing to effusion of blood, which may fill up the anterior chamber, and possibly the vitreous as well. It is much better, therefore, to wait until the blood is sufficiently absorbed, which it will be in a few days, before pronouncing any definite opinion regarding the extent of the injury and the prognosis.

Injuries of the sclerotic from blunt objects, e.g. a blow from a fist, may cause rupture of the globe, which takes place at the weakest part of its coat, just behind the limbus. The rupture does not necessarily involve the conjunctiva as well as the globe; in these circumstances the wound is subconjunctival and therefore less liable to infection from without, so that suppuration or sympathetic inflammation, which constitutes the great danger in rupture of the globe, is less to be feared. Many parts of the eye are likely to be injured in rupture, but it is difficult at first to make out the extent of the damage owing to the great effusion of blood, which fills the anterior chamber and hides from view all the parts concerned. When this has cleared up, the parts can be more satisfactorily examined, if necessary under an anæsthetic.

Some of the following structures may now be found to have been injured or displaced. The *iris* may be dilated (traumatic mydriasis) or the sphincter iridis may be definitely ruptured, the iris may be torn away from the root at some part (irido-dialysis), it may be anteflexed or retroflexed, or it may be prolapsed through the wound, either alone or with the ciliary body. The *lens* may be

dislocated backwards into the vitreous, forwards into the anterior chamber, or outside the wound underneath the conjunctiva (subconjunctival dislocation), when a swelling is seen near the wound in the sclera underneath the undamaged conjunctiva ; or there may be a concussion cataract, due to rupture of the posterior capsule, whereby the aqueous fluid gains access to the lens matter and causes opacity and swelling of the lens. In wounds of the *sclera* far back in the globe the vitreous escapes. Serious complications may arise, and all attempts at replacement are attended with more harm than good.

Whenever the lens is dislocated into an abnormal position inside the eyeball without rupture of the sclera, the ocular tension is liable to be raised, which greatly increases the difficulties of treatment and often results in the loss of the eye.

Damage to the *fundus* may take the form of rupture of the choroid, commotio retinæ, or detachment of the retina. These injuries can only be diagnosed by those who are thoroughly expert with the ophthalmoscope, but the practitioner may suspect their existence by occasionally making careful records of the vision during the period of recovery ; he will then notice that, in spite of the fact that all the external evidences of the injury are gradually clearing up, the vision remains consistently below normal.

There is very little pain in connexion with these severe injuries, and often nothing helpful can be gained from the history except that the patient notices that the sight has not been so good since the accident as it was before.

Treatment.—Whatever may have happened as a result of the injury, *atropine should always be instilled*, cold compresses applied, and rest insisted upon. If any iris is prolapsed and hanging out of the wound, it must be freely excised at the earliest possible moment ; there is danger in delay, and after a certain time the iris can never be re-

placed. Unless it can be removed at once, it becomes firmly attached to the wound by adhesions and is involved in the scar, while if it is left more than a week it is better to postpone the operation until the eye has quieted down, though this will probably be greatly delayed owing to the presence of the prolapsed and adherent iris, and the risks of infection and sympathetic inflammation are similarly increased. To deal with prolapsed iris properly requires special experience, and the practitioner will be wise to call in further advice. If there is a wound in the sclera, this has to be dealt with at the same time. Of course, no stitches need be applied if the wound is subconjunctival, and it is doubtful if they are of much value even if the conjunctiva is involved. A conjunctival flap is perhaps the best method of covering the wound, the sclera healing beneath it from the mere approximation of the edges. It is much easier and quicker to make this flap than to insert stitches in the sclera ; if the wound is far back in the globe, vitreous continues to escape freely all the time the necessary manipulation is taking place, and this ought to be avoided if possible.

The lens must never be disturbed if it is dislocated beneath the conjunctiva, as it is readily absorbed, and there is danger of converting a closed subconjunctival wound into an open one.

Apart from the various operative procedures, the eye must be kept clean by constant irrigation with mildly antiseptic lotions, e.g. boric acid and normal saline.

A simple wound of the conjunctiva without disturbance of the contents of the eyeball readily heals.

Perforating wounds of the cornea with a sharp instrument or a small flying piece of metal are fairly common injuries, and are liable to be followed by the most serious complications. Little pain is complained of, and the patient's symptoms are not always helpful ; sometimes he does not come for advice until the sight is affected.

The first thing that will happen in a perforating wound of any size is discharge of the aqueous and prolapse of the iris. In these cases the diagnosis can be made more easily than in those in which rupture of the sclera occurs from blows with a blunt instrument, since there is less effusion of blood. If a careful examination be made, prolapse of the iris need not be overlooked; the anterior chamber is shallow, perhaps more in one part than another, and although the chamber is quickly re-established after blocking

Fig. 5.—Adherent leucoma.

of the wound with iris tissue, the pupillary border being drawn up to the wound, a sharp angular oval-shaped pupil is formed which is characteristic—an appearance resembling adherent leucoma (Fig. 5).

The lens may be wounded, the capsule being generally ruptured, and a traumatic cataract follows; but if the opening in the capsule is only a small one the opaque lens matter is unable to escape, so that the lens swells and secondary glaucoma may occur. Unless the foreign body is sterile, septic infection, panophthalmitis, and sympathetic inflammation may develop later on; and the possibility

of such an eventuality may be suspected if the eye does not quiet down steadily in a reasonable time after the preliminary normal reaction due to the injury. Three or four weeks is the time usually regarded as reasonable for an eye to settle down, and suspicion should be aroused if the inevitable reaction does not subside in this time. When panophthalmitis is about to supervene, which it generally does within a week of the injury, pus begins to form in the anterior chamber and soon fills the whole space between the iris and the cornea, completely hiding the former from view, so that it looks at first as if the whole of the cornea were infiltrated with a dense white exudate. This generally ends in complete disintegration of the contents of the eyeball, and the eye has to be excised.

The onset of sympathetic inflammation is more difficult to detect, depending clinically as it does on the appearance of the signs and symptoms enumerated on p. 120 Such signs and symptoms call for excision of the exciting eye.

Smaller foreign bodies, such as small fragments of steel, are very dangerous, the wound of entrance being scarcely perceptible except under a strong magnifying glass. Such foreign bodies may be retained in different parts of the globe, and unless removed may cause trouble in various ways—siderosis, sympathetic inflammation, etc. The only indication of their presence is a very minute linear wound in the cornea which has quickly healed up, a hole in the iris, or an opaque lens. Removal is best effected by some of the powerful electro-magnets (Haab or Mellinger), but the general practitioner will not have an instrument of this kind, and besides, a good deal of experience is necessary if the foreign bodies are to be removed with the least possible disturbance to the different parts of the eye. On the other hand, some foreign bodies of this nature remain embedded in the eye for many years without

causing complications, and, if they cannot be removed by the magnet, the question will arise whether it is not better to leave them alone, especially if the eye is quiet and shows no signs of reaction, even though a careful X-ray photograph has demonstrated their locality. Often more harm is done by attempts at removal than by leaving the foreign body to become encysted.

To decide such difficult questions as this, an expert opinion, as in all severe injuries of the eye, should be sought. In no cases are anxious friends more likely to press the doctor for a positive opinion than in these. If there is perception of light (*see* p. 24) it is always worth while to make an attempt for a certain time to save the eye, *whatever the injury may be or wherever the wound may be situated.* Many eyes which were formerly regarded as hopeless are now saved and ultimately become useful organs of vision, especially if something should occur to destroy the vision in the sound eye. The practitioner's duty, therefore, in any case of serious injury to the eye, is to tie up the wound, like any other wound—in this case with a pad and bandage over the closed lids—put in atropine, give as encouraging a prognosis as possible, call in expert advice at once, and avoid committing himself to the opinion that the eye is in a hopeless condition or must be excised.

CHAPTER XIII

SYMPATHETIC OPHTHALMIA

A CERTAIN amount of knowledge exists in the public mind regarding the fact that a healthy eye may become affected as a result of injury to or disease of the other; and the question whether a sound eye is likely to be attacked in this way is often asked. The general practitioner should understand, therefore, how this condition is brought about, and what are the probabilities in any given case, in order satisfactorily to answer such questions.

Sympathetic ophthalmia is an irido-cyclitis, produced by a special organism, not yet definitely discovered, which shows a peculiar affinity for the ciliary body. It is caused by an infection from without, either by the entrance of a foreign body or through an operation wound; in other words, an extraneous organism gains access *through a wound*. Unless there is or has been a wound, the question of sympathetic inflammation need not, therefore, be considered. On the other hand, whenever there is a penetrating wound of the eye the possibility of this contingency must always be present to the mind, until there is evidence that all danger of such a calamity has passed.

The prevalent idea that a wound in the ciliary region is more dangerous than elsewhere is exaggerated, as also is the fact that sympathetic inflammation can occur several years after the original injury. Injured eyes may be the subjects of cyclitis, but not all such cases are due to the organism of sympathetic ophthalmia, and the exceptions are more numerous in cases in which the wound has soundly healed and the eye has been quiet for a very long period. While, as mentioned above, the organism has not yet

been isolated, recent observations indicate that the disease is a protozoan infection and behaves in the same manner as other infection of the same group. The blood shows increase in the large mononuclear cells and decrease in the polymorphonuclears, and there is a positive Wassermann reaction ; sympathetic inflammation, again, has shown considerable improvement and even recovery after injections of salvarsan, neosalvarsan, galyl, and allied preparations.

An eye that has been wounded or operated upon should, after showing an initial healthy vascular reaction lasting a few weeks, gradually and steadily quiet down. If it fails to do so in a reasonable time (three to four weeks) the onset of sympathetic ophthalmia may be apprehended, and we may look for the unfailing sign of irido-cyclitis, the presence of leucocytic precipitates (K.P.) on the back of the cornea (*see* p. 93). When these are present the organism is already at work, and it is doubtful whether its development can then be prevented by excision of the exciting eye. At the same time, if the sound eye is still unaffected I think this should be done, unless the inflammation in the exciting eye quickly subsides under treatment.

Unfavourable signs are sensitiveness to light in both eyes, even when the exciting eye is covered, and lacrymation, so-called sympathetic irritation, which is really only an early stage of sympathetic inflammation, and a continuance of the ciliary injection, some tenderness of the eyeball, a greenish-coloured iris, lowered tension, and progressive loss of vision.

It is not reasonable to expect the general practitioner to decide what is to be done in such cases, or to speak positively one way or the other as to excision ; the question is a most difficult and responsible one even for an expert, and further advice should be sought at the earliest possible moment.

Treatment.—This should be on the same lines as for any other form of cyclitis, so far as local measures are

concerned. Those measures are atropine, hot bathing of the outside of the eyes, leeches or blisters to the temples, and dark glasses.

General treatment likely to influence the course of the inflammation consists in mercurial inunctions, with a hot-air bath every other day, and, in the light of recent researches, intravenous injections of salvarsan or an allied compound.

The exciting eye should be excised unless it quiets down in a reasonable time, and, if possible, before the appearance of K.P.

When both eyes are definitely affected with sympathetic inflammation it is better not to excise the exciting eye, since it may prove ultimately to be the better of the two.

CHAPTER XIV

FUNDUS CONDITIONS

THE various and complex diseases of the fundus (inflammations and rupture of the choroid, optic atrophy and papillœdema of the disc, retinitis and retinal detachment, diseases of the retinal vessels, etc.) are a fascinating study to those who have time at their disposal and have gained the necessary experience in this special branch of ophthalmology, but the general practitioner, as a rule, is too much occupied with his ordinary work to spare the time required for ophthalmoscopic examination.

There are three difficulties to be overcome in the use of the ophthalmoscope. The first is to get beyond and learn to disregard all the various reflections from mirrors, cornea, etc., and obtain a view of the interior of the eye ; the second is, when at last the different parts of the fundus are easily seen, to distinguish the many varieties of the normal and to recognize what is actually abnormal ; the third is, having definitely decided that a condition is abnormal, to interpret correctly and put into pathological language what is seen. It is extremely difficult, with the material at his disposal, for the practitioner to master these three difficulties, as is pointed out in Chap. I., but none the less he can make very effective use of his ophthalmoscope in a way that needs very little experience and takes up far less time.

The examination of the red reflex of the fundus, as we have seen in earlier chapters, not only affords the most reliable information regarding the condition of the different media of the eye, but is also valuable in determining any variations in the red reflex itself. The fundus gives a red

reflex (Plate 5, Fig. 1) because the light is reflected from a highly vascular structure, the choroid, seen through the pigmentary epithelial layer of the retina, and this reflex should be uniform, to whatever part of the fundus the light may be directed ; any change in its hue shows, therefore, that, apart from opacities in the media, there must be an abnormality in some part of the fundus to cause this change.

An inflammation of the choroid starts as a raised patch of localized cellular infiltration which causes a yellowish-white deposit in the stroma of the choroid at some particular spot ; if, therefore, the reflex is normal in most parts of the fundus, but changes to white in one place, we know that there is some abnormality, most likely pathological, in this region. Again, the acute inflammations of the choroid are accompanied by pigment proliferation in the later stages, which causes large masses of pigment to be segregated round the inflammatory patch ; and when this has settled down into a definite scar, formation of fibrous tissue follows with masses of pigment surrounding it. The reflex in this case would show a white area with black deposit near it.

In detachment of the retina, the retina is separated from the choroid, and the space is occupied by a collection of albuminous fluid which is more or less opaque, and the red reflex is modified ; in its place a greyish reflex will be seen over the detachment, while the rest of the fundus is red. Further, when the patient is asked to move his eye up and down, the grey reflex will be seen to move.

These are a few of the examples of the variations in the red reflex which indicate some pathological condition of the fundus, and although one may not be able, without considerable experience with the direct method of ophthalmoscopy, to apply a name to the disease, one has gone a long way towards accounting for the defect of vision

which has already been discovered in our routine examination.

As some practitioners will wish to carry their investigations of the fundus further, and to use the ophthalmoscope to supplement other signs in the diagnosis of medical cases, as well as to make a more precise diagnosis in diseases of the fundus, I will endeavour to lay down some additional rules for their guidance and to describe some of the commoner cases.

In order to arrive at anything approaching a trustworthy diagnosis the following rules must be observed :

1. Always examine an eye under a mydriatic (homatropine and cocaine, of each 2 per cent.), except in cases in which liability to glaucoma is suspected (*see* p. 39).
2. Always compare the two fundi.
3. Never pronounce as definitely pathological any condition found in the fundus by judging from the picture alone.
4. Always record the vision accurately, and if possible, in doubtful cases, the field of vision as well.
5. Remember that pathological conditions of the optic nerve and macula always produce a serious effect on the vision, whereas very gross and even dangerous pathological changes can occur in other parts of the fundus without giving rise to any pronounced deterioration of central vision. Chronic glaucoma is perhaps the single exception, for here the optic nerve is the part affected, though it is true that the condition is usually revealed by a contraction in the field on the nasal side.

In forming an opinion on any disease of the fundus, we must take account of the following changes in the normal picture, as seen with the ophthalmoscope :

1. White or yellowish-white areas of different shapes and sizes, which are caused by exudation of albuminous fluid, by the formation of fibrous tissue, or by gaps in the choroid showing sclera exposed to view.
2. Hæmorrhages, which are always red and assume different shapes and sizes according to the position they occupy in the various tissues.
3. Pigmentary deposits, which may be excessive and proliferated, or only fine and granular, and arranged in different formations. It is important to remember that any pigmentary changes are always associated with diseases of the choroid and choroidal circulation, owing to the fact that the choroid is a pigmented structure.
4. Alterations in the appearance of the optic nerve and retinal vessels.

Finally, we must appreciate the relationship of each and all of these changes to the normal structures.

With these various points fairly fixed in the mind, let us consider the appearances in fundus diseases, bearing in mind that all examinations of the fundus must be conducted in a systematic order—first the optic nerve and vessels, then the macula, and lastly the rest of the fundus.

The normal fundus (Plate 5, Fig. 2).—The **normal disc** is a circular area (actually 1·5 mm. in diameter, but magnified by the ophthalmoscope) of a paler-red colour than the rest of the fundus, and situated slightly to the nasal side of the posterior pole of the eye, in which position it must be looked for when examining by the direct method of ophthalmoscopy.

It is marked off from the other parts of the fundus by a well-defined margin, which generally is bordered with some choroidal pigment, variable in amount, but sometimes excessive, especially on the temporal side.

In the centre of the disc is a small white area which varies in size and is called the *physiological cup*. It is here that the nerve-fibres separate from the main nerve-trunk to spread out in their distribution to the retina, and sometimes there is sufficient space between the fibres to form a moderately deep cup, at the bottom of which the lamina cribrosa is visible as a grey stippled membrane.

Out of this cup the central retinal vessels emerge, and, after breaking up into their several branches, follow a slightly tortuous course towards the edge of the disc, to be distributed over the retina. The veins look darker than the arteries owing to the character of the blood contained in them, and the arteries are brighter and often decidedly brilliant near the disc, but this has not the same pathological significance as brilliancy of the smaller arteries. Pulsation of the veins on the disc is physiological in 70 or 80 per cent. of cases.

The **macula** is situated about two disc-diameters away from the disc on its temporal side, and is difficult to see with an undilated pupil, owing to the contraction of the latter which takes place when light is thrown on the macula. There is nothing special to be seen except a uniform dark area like the rest of the fundus, but perhaps slightly darker in colour, because the choroidal pigment is generally more abundant in this region. The retinal vessels surrounding the macula consist of very small terminal branches, and actually at the *fovea* there is no retinal circulation at all. Thus the distinguishing features of the macular region may be said to be negative in character.

The rest of the fundus has a uniform dark-red appearance, which colour is imparted by the comparatively large choroidal vessels showing through the pigmentary epithelial layer of the retina, and the red colour is lighter or darker according to the amount of pigment contained in the stroma of the choroid. Sometimes this pigment is so excessive that it is plainly seen through the **retinal pigmentary layer,**

or the latter may be rather thinner than normal, in which case quite definite, regularly arranged masses can be seen in between the tracks of the choroidal vessels, but the evenness and regularity of the pigment serve to differentiate it from the pathological proliferation to be described later on.

In some instances the retinal pigmentary layer contains so little pigment that the individual choroidal vessels can be distinctly seen as broad ribbon-like vessels running side by side in more or less straight lines across the fundus ; and the extreme anterior part of the visible fundus is often normally paler than elsewhere.

Over the whole of the fundus the **retinal vessels** branch in all directions, and can be traced and examined in the greater part of their course.

Although there are many variations in the appearance of the normal fundus, the general characteristics above described are common to all.

Optic nerve.—The physiological appearance of the optic nerve varies considerably in perfectly normal cases, but the chief points to note are the margin and colour of the disc, the small white area in the centre called the physiological cup, and the arrangement of the vessels as they emerge from the disc (Plate 5, Fig. 2).

Optic atrophy.—Although cases of atrophy are usually associated with pallor of the disc, it is a mistake to form any definite opinion from the colour of the disc alone, since many very pale discs are quite compatible with perfectly normal vision, and therefore, in order to arrive at a correct conclusion, a record both of the vision and of the visual field must be carefully taken.

Atrophy may be either *primary* or *secondary*. Primary atrophy in its typical form show paleness of the disc, with the lamina cribrosa plainly visible, and a well-defined margin, but with no diminution in the size of the retinal vessels until the case reaches an advanced stage (Plate 5, Fig. 3). Secondary atrophy, on the other hand, shows

a papery white disc, an ill-defined margin, and the retinal vessels reduced in size (Plate 5, Fig. 4).

There are many cases intermediate between these two typical forms, but as the causes of primary atrophy are very few, a rough rule to follow is that any doubtful cases are more likely to be secondary than primary.

Secondary atrophy is so called because it follows as a late result of optic neuritis, choked disc, retrobulbar neuritis, pigmentary degeneration of the retina, embolism of the central artery of the retina, etc.

In both primary and secondary atrophy the vision is seriously affected, and there is some change in the visual field. Primary atrophy shows general concentric contraction, and it may be the same in secondary, but here there are many variations, such as central scotoma with a good peripheral field, ring scotoma, patchy scotomata in many parts, etc., or absence of any field at all in advanced cases. In extensive atrophy there is often a gradual shelving in the disc, forming a saucer-like cupping, which will be contrasted later with glaucomatous cupping.

Papillœdema, choked disc, or optic neuritis.—This condition is caused by obstruction in the optic-nerve sheath, and is generally produced by increased cerebral pressure, from tumours, etc. It is characterized by the following signs, viz. blurring of the edge of the disc, fullness and tortuosity of the veins, swelling of the disc, and obliteration of the physiological cup (Plate 6, Fig. 1). Nothing short of the presence of all these signs together must be accepted as evidence of papillœdema, since any two of them are frequently found associated without the presence of any pathological condition whatever, and even cases have been described in which all the typical signs are in evidence and yet the condition is merely one of pseudo-neuritis. It is therefore of the utmost importance to obtain a record of the visual acuity, in addition to the ophthalmoscopic signs.

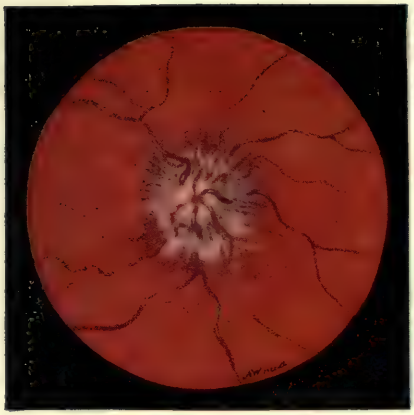

Fig. 1.—Papillœdema.

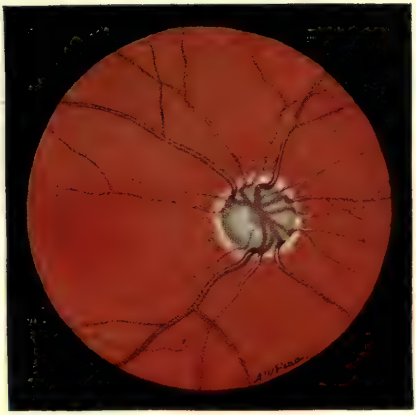

Fig. 2.—Glaucomatous cupping.

Fig. 3.—Opaque nerve-fibres.

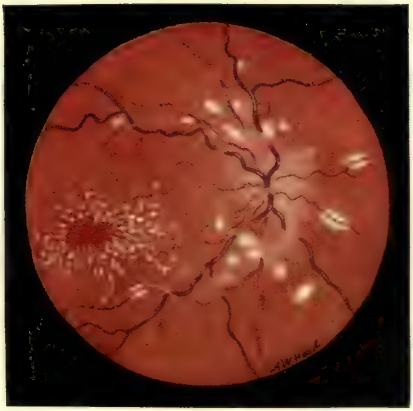

Fig. 4.—Albuminuric retinitis.

PLATE 6.

The swelling of the disc and the blurring of its edge are both due to albuminous exudate which is thrown out from the distended vessels. In many instances several hæmorrhages are seen in addition to the exudate, and these hæmorrhages are noticed mostly near or on the disc, as opposed to those seen in thrombosis of the central vein and other vascular changes, when they are more widely distributed.

Glaucomatous cupping of the disc.—This is sometimes the only sign indicating the presence of chronic glaucoma, since all the leading symptoms are often in abeyance when patients come for examination. The excavation of the disc, caused by the recession of the lamina cribrosa, is characterized by an enlargement of the physiological cup in such a way that a well-defined, overhanging margin is developed (Plate 6, Fig. 2), which approximates nearly to the edge of the disc itself, so that there is only a small piece of normal healthy nerve between the two margins, and the exit of the central retinal vessels is thus considerably altered. These vessels emerge from the disc in the usual way, but from the bottom of the cup ; and it is found that in order to focus them clearly a concave glass of varying strengths is needed.

Owing to the normal tortuosity which characterizes the vessels, they appear to lose their continuity when traced from the centre to the point where they leave the margin of the disc ; this is due to the fact that the turn in the vessels is made on a different plane and that they are partially hidden in their course by the overhanging edge of the cup.

In cupping due to atrophy the shelving is more gradual, and since there is no overhanging edge there is no loss in continuity of the vessels, which can be traced in their whole course ; this constitutes the difference between the two forms.

If the appearance described above is seen, or even

suspected, the field of vision should be carefully taken, when a contraction on the nasal side will generally be noticed.

Opaque nerve-fibres.—These are sometimes mistaken, by those not experienced in the use of the ophthalmoscope, for the œdema seen in optic neuritis. They are visible as a white mass of tissue continuous with the margin of the disc and passing out a short distance into the fundus (Plate 6, Fig. 3). This white area has feathery edges, and might conceivably look like an exudation of albuminous fluid ; but the points to remember about it are that this white tissue does not extend completely round the whole disc ; parts of the disc being, as a rule, perfectly clear and well defined. Had this white tissue been œdema of such a severe type as to extend so far out beyond the disc margin, no part of the disc would remain clear, especially in the centre of the physiological cup, and there would probably be some hæmorrhages in addition to the other signs of vascular obstruction.

Diseases of the retina.—Since there is no pigment in the retina, inflammatory and hæmorrhagic changes are unaccompanied by any pigmentary disturbance ; and, speaking generally, the absence of pigment, other pathological signs being present, is evidence of a retinal rather than a choroidal cause.

Albuminuric retinitis.—This condition is associated with a collection of white masses of exudate of different shapes and sizes, situated near the macula and the disc, together with general œdema of the retina which extends in all directions, and in its extension involves the optic disc and causes blurring of the edge, while if excessive in amount it may even fill up the physiological cup. (Plate 6, Fig. 4). The exudates at the macula are sometimes so numerous that they form a star figure with masses radiating in lines from the fovea ; mixed up with the exudates are many round or flame-shaped hæmorrhages,

according to whether they are situated in the nuclear or the nerve-fibre layer.

There is also evidence of thickening of the arteries, shown by the indentation produced on the veins wherever these vessels cross each other.

Diabetic retinitis.—This is very similar in appearance to the albuminuric type so far as the exudates and hæmorrhages are concerned, but the exudates, when excessive in amount, tend to separate into larger or smaller groups without the formation of the star figure, and the hæmorrhages are round rather than dotted (Plate 7, Fig. 1). No accompanying vascular change is in evidence except that in advanced stages fat appears in the blood-stream, giving the circulation in the vessels a curious and characteristic appearance.

In both albuminuric and diabetic retinitis the vision is often considerably below normal, and in any case is affected to a certain extent, and patients who are the subjects of either of these conditions complain that their sight is blurred.

Embolism of the central artery of the retina.—This is one of the causes of sudden loss of sight; and on testing such patients it is found that practically there is no light perception, though as a matter of fact a very minute area on the temporal side of the field is still preserved. The fundus appearances are confined entirely to the macula, which is transformed into a large yellowish-white œdematous area with a round red spot in the centre (the so-called cherry-red spot) which represents the unaffected choroidal circulation showing at the fovea (Plate 7, Fig. 2). The œdema subsides in a few days, to be followed by a secondary atrophy of the disc, and the rest of the fundus, including the macula, will then take on a perfectly normal aspect.

In the initial stage there is no blood in the retinal artery, but the circulation is quickly re-established through

anastomosis with the choroidal vessels near the disc, but without any restoration of function.

The treatment of this condition is very unsatisfactory, and the only hope is that the embolus may pass on immediately into some smaller retinal vessel where it will do comparatively little harm to the vision, cutting off only a small part of the peripheral field; any treatment that has ever been suggested is directed towards this end.

Thrombosis of the central vein.—In this condition patients do not completely lose their sight in the early stage, though they complain of misty vision; presently there may be substantial or even complete recovery. In the severe cases, on the other hand, the sight is gradually lost.

Here the whole fundus is covered with enormous flame-shaped and round hæmorrhages, and mixed up with the larger collections there is a lot of white exudate. Although the hæmorrhages occur in greater number and larger size near the disc and macula, crowds of small ones can be found in the most distant parts of the fundus, and the veins also are very much dilated (Plate 7, Fig. 3).

The margin of the disc is often rendered indistinct and swollen by the amount of exudate overflowing on to the disc, since the whole of the retina is œdematous owing to venous obstruction.

Hæmorrhages may occur in the retina alone, unaccompanied by any exudate; they are generally due to the rupture of some diseased blood-vessels. These hæmorrhages are perhaps most common at the macula, and their presence there gives rise to sudden loss of sight.

If the hæmorrhage is not very severe, and the affected vessel is quickly occluded, it is retained in the retinal tissue; but sometimes the vessel from which the blood is extravasated remains open so long that a large amount of blood is lost, which bursts through the membrana limitans interna and collects between the vitreous and the

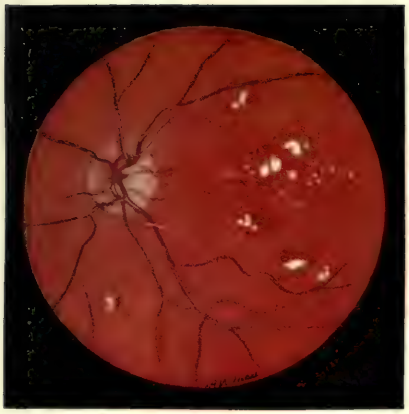

Fig. 1.—Diabetic retinitis.

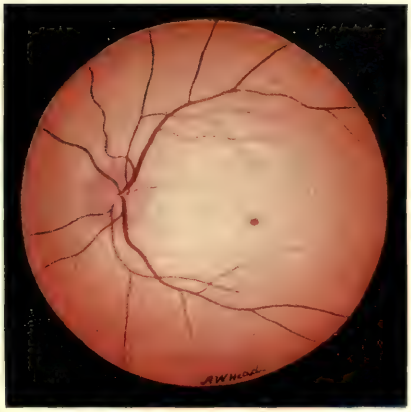

Fig. 2.—Embolism of the central retinal artery.

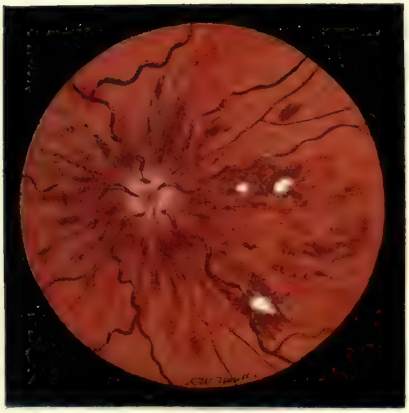

Fig. 3.—Thrombosis of the central retinal vein.

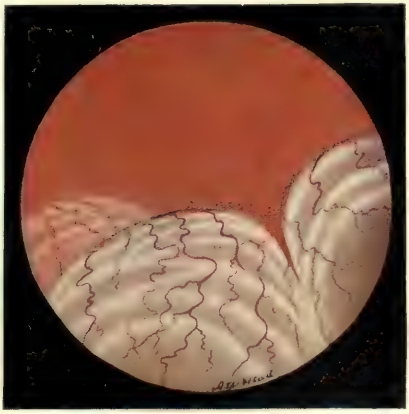

Fig. 4.—Detachment of the retina.

PLATE 7.

retina. In these circumstances a large circular collection of blood, about four or five times the diameter of the disc, appears generally near or exactly over the macula; it is called a subhyaloid hæmorrhage.

The hæmorrhages described show a dark-red reflex when looked at through the ophthalmoscope by reflected light, and all details of the fundus are hidden by them; but, although so large, they are not serious because the retina itself is so little damaged, owing to the situation of the blood, and they are quickly absorbed. At first, the effect on the vision is alarming, especially as patients suffering in this way often see objects red, but an encouraging prognosis can be confidently given.

Other hæmorrhages take place from the choroidal blood-vessels, and in this case the retinal vessels are distinguishable over the hæmorrhage, which is postretinal. Owing to the position which this extravasation occupies, the blood is confined in the tissues of the choroid and retina, and the hæmorrhage is therefore not usually so large as the subhyaloid, but the tissues involved are more seriously damaged, and thus the effect on the sight is more likely to be permanent. Some pigment may be mingled with the blood.

In all these cases where the blood-vessels are affected, the treatment should be on the lines of attending to the general circulatory system.

Detachment of the retina.—The retina, when it is detached, separates between the pigmentary epithelial layer and the neuro-epithelial layer (layer of rods and cones), and the space which is formed between these two layers is filled with albuminous fluid derived from the choroidal vessels. The retina, therefore, as is mentioned in an earlier chapter, appears as a membrane floating about on a fluid base, and this characteristic appearance is seen on examining for the red reflex, when a greyish-white movable curtain shows in some parts of the fundus instead of the

normal red reflex. In the early stages the detachment is generally in the upper part of the fundus, but in a week or two the fluid beneath the retina gravitates to the lower part and the detachment appears in this situation, while the two layers in the upper part become reattached.

The detachment should be examined in detail by the direct method of ophthalmoscopy, and since the retina is farther forwards than the rest of the fundus, it will require a high convex glass (say about 8 to 10 D) behind the sight-hole to focus the details clearly. In this way can be seen the retinal vessels, as well as the fibrous tissue which often develops on the surface of the retina. The retinal vessels appear smaller and blacker than normal, with their tortuosity exaggerated; the blackness is due to the fact that they are fixed to a liquid bed and reflect a good deal of light away from the observer. (Plate 7, Fig. 4.)

A good many vitreous opacities are usually associated with detachment of the retina; and it has been stated that some shrinking of the vitreous in varying degree always precedes any detachment, although there are several other predisposing causes, such as myopia, when the vitreous is often fluid; a blow on the eye; longstanding irido-cyclitis; old choroidal scars, with some fibrous bands formed in the vitreous as a result of them; and new growths.

The onset is generally sudden; this is in fact another of the cases in which the patient complains of having suddenly lost his sight.

All cases of retinal detachment should be regarded as very serious so far as vision is concerned; the possibility of the return of any useful vision is exceedingly remote, and the patient must be warned accordingly. Numerous operations have been invented, but with extremely unsatisfactory results; subconjunctival injection and bandaging the eyes, with or without rest in bed, have been advised,

but practically every method so far devised has been most disappointing. One of the best forms of treatment is rest in bed at the earliest possible moment for three weeks or a month, especially when the detachment is only threatening and has not actually taken place. The signs of an imminent detachment are very few, but I feel sure that in those who have the tendency to it (*see* p. 134) such symptoms as flashes of light and slight temporary obscuration of vision are of extreme importance, and should lead the surgeon to recommend immediate rest.

Leukæmic retinitis.—In this condition the whole fundus is a pale-yellow colour, with several white spots surrounded by a red border consisting of red blood-cells. The vessels are distended, but the blood contained in them is much paler than normal.

Diseases of the choroid. Choroiditis.—This may be met with as an acute condition or in the chronic form. It is very important to keep these two forms distinct in one's mind, for in acute cases treatment is necessary and urgent, whereas in chronic cases it is utterly useless.

In the early and acute stage all inflammations of the choroid present characteristics similar to inflammatory deposits in other parts of the body. There may be one or many such deposits in some part of the fundus, and at this stage they all appear as yellowish-white round or oval patches of different sizes with ill-defined œdematous edges, behind the retina, which is raised and pushed forwards by the mass of inflammatory material and exudate beneath (Plate 8, Fig. 1). This must not be confused with detachment of the retina, by which term an entirely different pathological condition is understood. When there are many such deposits scattered indiscriminately over the fundus, the condition is known as disseminated choroiditis; this is generally, though by no means invariably, the form seen in syphilitic cases. When there is only one isolated patch, it is almost certainly not of

syphilitic origin, but is due to other forms of auto-intoxication (e.g. tubercle). At this stage, one can often see vitreous opacities, and the vision is a good deal below the normal standard, though not entirely lost. The metastatic deposit may occur quite suddenly, thus giving rise to the history of " sudden loss of sight."

Unless the deposit is situated at the macula, recovery of sight practically to normal can be confidently promised, to the great relief of the patient, who is naturally in a state of great anxiety.

After a certain period, which varies in different cases, the œdema and exudate are partially absorbed, and in their place fibrous tissue is laid down and pigment begins to proliferate, so that in the end a white mass of fibrous tissue takes the place of the yellowish-white fluffy area, with masses of pigment round it and over it, and possibly one or two vessels crossing the floor of the patch which have escaped involvement in the scar tissue (Plate 8, Fig. 2). In this cicatricial tissue the retina is almost always involved, so that it becomes functionless, and there are blind areas wherever such a scar is found. No treatment is of the slightest avail when the inflammatory process has arrived at this stage.

All true inflammations of the choroid behave exactly in the way described above, the only difference being in the size, shape, and distribution of the affected areas.

Treatment in the acute stage consists in giving hot-air baths every other day, mercury inunctions, and subconjunctival injections. Often it has a most satisfactory result in promoting the rapid absorption of the inflammatory products before involvement of the retina has taken place, and thus the vision is preserved. To avoid a recurrence of the choroiditis, it is essential to discover and deal with the focus where the organisms or toxins originate.

Although some cases make a wonderful recovery, the prognosis must be guarded.

Fig. 1.—Red reflex of the fundus.

Fig. 2.—Normal fundus.

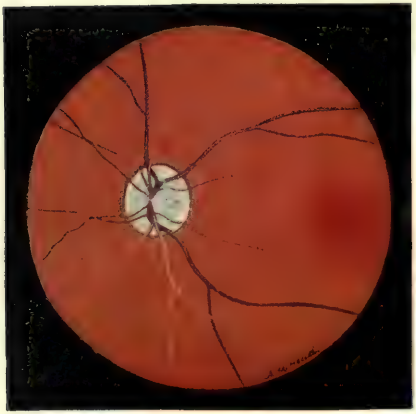

Fig. 3.—Primary optic atrophy.

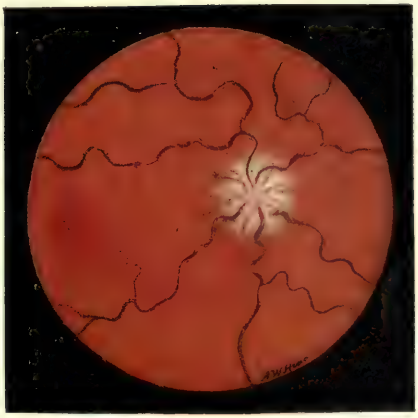

Fig. 4.—Papillœdema subsiding into secondary optic atrophy.

PLATE 5.

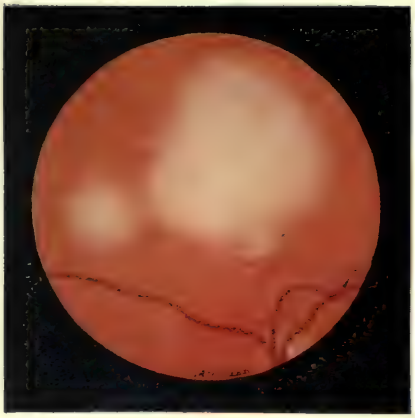

Fig. 1.—Acute choroiditis.

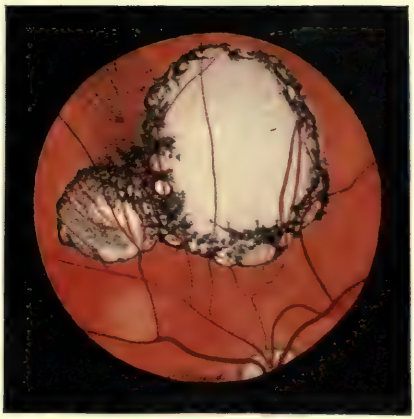

Fig. 2.—Scarring following acute choroiditis.

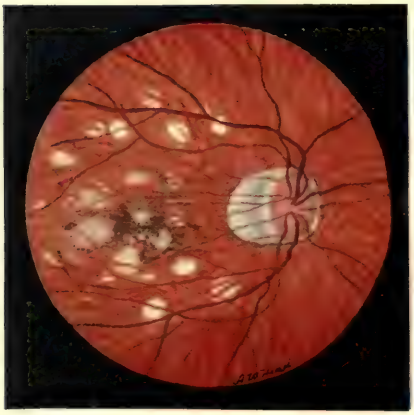

Fig. 3.—Myopic choroidal changes.

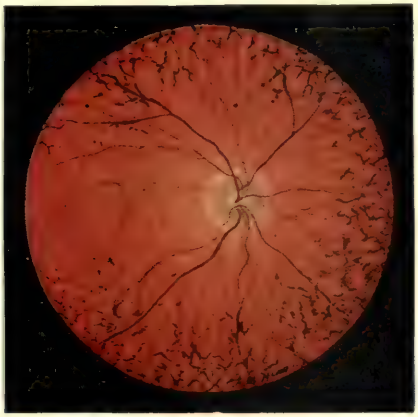

Fig. 4.—Retinitis pigmentosa.

PLATE 8.

Rupture of the choroid.—This usually follows a blow on the eye, and the actual fundus change cannot always be seen at first, owing to the large extravasation of blood into the vitreous from rupture of the choroidal vessels. When the blood has been absorbed, a narrow linear white scar outlined with a pigmentary border is seen in some part of the fundus, usually near the disc. This scar may be in the form of a straight line, with possibly one or two branches, but more often it is curved and concentric with the disc, between it and the macula.

The vision is, as a rule, seriously affected ; and nothing can be done to improve it.

Myopic choroiditis.—The choroiditis found in some cases of myopia may be the true inflammatory form as described above, but more often the changes consist merely in stretching of the choroid and disturbance, not proliferation, of pigment ; this gives rise to large white areas surrounded by a small amount of pigment arranged round the edge, and occasionally some small hæmorrhages (Plate 8, Fig. 3). The white areas are simply places where the sclera is exposed through gaps in the choroid. These changes almost always take place round the disc and at the macula, so that vision becomes seriously impaired. This is one of the dangers to be feared in advanced and progressive myopia, and when once it is established there is no hope of recovery.

Guttate or Tay's choroiditis.—This form appears as a collection of numerous minute white, more or less circular areas surrounded by a narrow margin of pigment, but no proliferation. Strictly speaking, it is not a choroiditis at all, but a degeneration of the membrane of Burch which causes elevations of hyaline material pushing forwards between the cells of the pigmentary epithelial layer; this accounts for the fringe of pigment round the spots. The vision is never affected, and the condition is therefore of no serious consequence.

Retinitis pigmentosa, or pigmentary degeneration of the retina.—This must be regarded as a choroidal affection, since it is the generally accepted view that the changes are due to destruction or impairment of the choroidal circulation in some part of its course (Plate 8, Fig. 4).

In the *primary* form the fundus looks very little different from the normal, except that in the mid-peripheral region there are pigmentary changes, manifested in the form of fine interlacing branches which have been likened to the microscopical appearance of the branchings of Haversian canals in bone. These changes are caused by disease of the chorio-capillaris which partially obstructs or completely interferes with the proper blood supply of the two posterior layers of the retina, so that the function of the latter is impaired. The symptoms complained of are night-blindness, and the sign, in addition to the pigmentary changes in the retina, is the presence of patchy scotomata in the visual field, starting with the ring scotoma, which is followed by involvement of the rest of the field, sector by sector, until the whole periphery is affected, and eventually central vision is lost. Then optic atrophy sets in and the patient becomes totally blind. The course of this complaint is extremely variable, and it is often many years before that termination takes place.

In *secondary* degeneration the same fine pigmentary branching arrangement is noticed, but the underlying choroid is disturbed, giving rise to a general greyness of the fundus; this is probably due to both vascular and inflammatory changes, so much cicatricial tissue being formed that the main trunks of the choroidal circulation are constricted and thus the blood supply is interfered with. This represents the so-called retino-choroiditis, which I consider a bad term, if reserved for this condition alone.

Treatment must obviously be directed to improving the general circulation, in order to ensure as full a

supply of blood as possible, especially in the terminal capillaries.

Coloboma of the choroid.—This congenital failure of development is situated almost always in the lower part of the fundus, and its upper margin may reach close up to the optic disc. There is a large white pyramidal area seen with its apex towards the disc and bordered with choroidal pigment, just as when the choroid stops short at the edge of the disc, where there is often a slight excess of pigment. Proliferation never occurs. The white area is really sclera exposed through the gap of undeveloped choroid, and as this is fibrous tissue it is visible as a white surface. There are scarcely any vessels crossing this patch, as in some choroidal scars, because none were developed, but there may be just a few to be seen, generally at the side of the patch.

In testing for the red reflex, this area in the fundus shows up as white.

Sarcoma of the choroid.—This form of new growth is occasionally met with. It is usually visible by direct ophthalmoscopic examination as a pigmented swelling of varying size projecting forwards into the interior of the eyeball and pushing the retina in front of it so that the summit of the growth is focused with a higher glass than the rest of the fundus. A feature which is characteristic of a new growth is the presence of an ordinary detachment in the retina adjacent to it.

The tumour may occur in any part of the fundus, and the vision in the eye is almost always lower than normal, but it depends upon the position which the growth occupies how low the deterioration in vision sinks. The condition is a dangerous one, and likely to extend beyond the eye to other tissues and lead to fatal results, so that excision of the eye becomes an urgent matter; but however confident the practitioner may be of the diagnosis, a second opinion should always be sought.

Glioma of the retina is a form of malignant growth which is found exclusively in children up to the age of seven. It gives rise to a yellow reflex by reflected light, and by direct ophthalmoscopic examination convoluted masses of white nodular tissue are seen covered by the retina, which is pushed forwards and forms part of the growth ; the tension is often though not invariably raised, and the iris frequently has a translucent appearance. The condition is very malignant, and calls for immediate excision. A very guarded prognosis must be given, since recurrence is very likely to take place in the orbit. If there is no recurrence in three years, the patient may be considered safe ; but the other eye must be carefully watched from time to time.

CHAPTER XV

SYMPTOMATIC DISTURBANCES OF VISION

It is a good thing for the general practitioner to have at any rate a superficial acquaintance with certain disturbances of vision for which patients frequently come for advice. Although some are of little importance, others are indicative of diseases of the eye which require treatment or about which advice can and ought to be given.

Night blindness is one of these symptoms. Patients complain that they see badly as soon as it becomes dusk, and are practically blind at night. We must be quite clear that the symptom is accurately described. Some patients report that they see badly at night when they only mean that they find it difficult to read and do needlework as soon as artificial light is turned on in the evening; this is one of the earliest signs of the advent of presbyopia, and is not associated with any disease. True night blindness points to disease or extreme fatigue of the retina; it is seen in pigmentary degeneration of the retina, and in scurvy and other diseases due to malnutrition. The rods situated in the peripheral parts of the retina are the organs concerned in dark-adapted visual sensations, and in degenerations of the retina the rods are the first structures to lose their function.

Day blindness, which means that vision is worse in a bright light than in the dusk, is associated with central opacities in the lens. In a bright light the pupil contracts strongly, so that only the central part of the lens is available for the passage of light, and this being opaque, an insufficient amount of light enters the eye; thus this symptom is an early indication of cataract. Affections of the macular

region, too, will be associated with day blindness, for when this light-adapted portion of the retina is diseased, patients have to rely on the parts outside the macula for practically all the vision they possess. If the nerve-fibres from the macula (papillo-macular bundle) are affected, the same symptoms are produced; thus in tobacco amblyopia, retrobulbar neuritis, etc., day blindness will be complained of, and also in some cases of early optic atrophy. A confirmatory symptom in retrobulbar neuritis is a central colour scotoma.

Another sign of commencing cataract is for a patient to complain of defective distant vision, although he is able to read without his presbyopic glasses. This shows that the lens is swelling—the first stage of opacity, and thus the eye becomes artificially myopic.

Hemianopia is a symptom patients sometimes complain of, though it is more often discovered by the practitioner when investigating the field of vision in affections of the nervous system. Sometimes it follows an accident.

A careful perimetric chart is desirable, but this requires a good deal of time and patience.

Bitemporal hemianopia is a sign of disease of the pituitary body.

Amblyopia is the term applied to defective sight in cases where no visible fundus changes can be found, nor any other cause. Among such cases are those of old squinting eyes in which the eye has become straight from readjustment of the muscle-balance but the macula has never been developed, owing to the fact that the eye has remained for so long in a position of deviation. Amblyopia also occurs in diabetes and uræmia.

Scintillating scotomata and **flashes of light** are associated with attacks of migraine, and may also be an early sign of detachment in those predisposed to its occurrence, as in high myopia or following a blow. It denotes retinal irritability and fatigue.

Disparity in the size of the images on the two sides, unevenness or a curvature in a straight line, either vertically or horizontally, defective parallelism in lines in a page of print, etc., all point to some disease of the macula which may be so slight as almost to escape the observation of an expert. Such symptoms must be taken very seriously. They are due to a displacement of the cones, which produces distortion of images.

Colour blindness is a subject about which there is a good deal of controversy even amongst experts, and it is so complicated that it is hardly worth the general practitioner's while to try to master it.

CHAPTER XVI

OCULAR MANIFESTATIONS OF NERVOUS DISEASES

THE general practitioner must continually keep before himself the possibility of certain eye symptoms being the precursor of some disease of the nervous system, and having nothing to do with any condition local to the eye.

The symptoms and signs generally fall under one of the following headings, viz.: (1) *Lowered visual acuity*, which cannot be accounted for by any refractive error nor corrected by glasses. (2) *Diplopia*, due to temporary or permanent paralysis of one or more of the extrinsic ocular muscles. (3) *Nystagmus* (not congenital). (4) *Failure of accommodation* and weakness of other ocular muscles. (5) *Abnormalities in the field of vision*, such as blind spots in various places, scintillating scotomata, hemianopia, etc. (6) *Inequality of the pupils, and irregularities in their action*, e.g. Argyll-Robertson pupil. (7) *Condition of the optic nerve*, e.g. papillœdema, well-marked optic neuritis, optic atrophy.

It is not easy for the practitioner, unless specially versed in disorders of the nervous system, to investigate fully all the above signs, some of which are very complicated. For instance, it is not difficult to detect the existence of diplopia, even when the patient does not complain of double vision, by means of a red and a green glass, as described in the chapter on URGENT CASES IN GENERAL PRACTICE (p. 33), but unless one is constantly testing such cases, it may be difficult to be sure of the particular muscle or muscles involved, and thus what cranial nerves are affected. The presence of diplopia, however, is established, and the case can be referred to a neurologist if desired.

Ocular Symptoms of Nervous Diseases

To map out blind spots in the field of vision, and to chart the hemianopic fields, require a good deal of experience in the use of special instruments which the practitioner is not likely to possess, but the patient's history of such blind areas should never be neglected ; they should be carefully noted, and a rough estimate can be formed of the position of these defects in the visual field by means of the tests already described (p. 23).

Inequality and irregularity of the pupils can be quite easily investigated by the general practitioner (*see* pp. 12 and 13), and he can make valuable notes of their condition, though he may not fully appreciate their significance as a sign of nerve disorder.

Conditions of the fundus, such as atrophy of the optic nerve, and papillœdema, are of vital importance in conjunction with other symptoms and signs, but to diagnose the type of atrophy and the degree and progress of the papillœdema, points upon which so much depends, requires constant experience with the ophthalmoscope.

Some of the commoner forms of nervous disease associated with ocular signs and symptoms are :—

Tabes dorsalis	Primary atrophy ; Argyll-Robertson's pupil ; partial paralyses of extrinsic muscles.
Disseminated sclerosis . .	Scotomata (blind spots) ; retrobulbar neuritis ; temporary paralyses ; nystagmus, etc.
Diseases of the pons . .	Paralyses of 6th and 7th nerves ; loss of conjugate movement, etc. ; small pupils ; papillœdema, etc.
General paralysis of the insane	Ophthalmoplegia interna and externa.
Intracranial tumours and meningitis	Papillœdema and muscular paralysis.
Myasthenia gravis . . .	Ptosis and failure of accommodation.

CHAPTER XVII

SQUINT AND MOTOR ANOMALIES

ALTHOUGH it is not essential, nor even advisable, for the general practitioner to carry through on his own account the treatment of a case of squint in every detail, he must be perfectly familiar with the various steps necessary to bring about as satisfactory a cure as possible, *both as regards the deformity and also the preservation or restoration of the visual acuity in the squinting eye.* Parents are naturally most anxious about the former, but do not appreciate the latter owing to the fact that, when both eyes are open, the visual acuity is judged by the fixing eye and is sufficiently useful to create the false impression of good sight in both. The practitioner sometimes falls into the same error, and, knowing that a squinting eye in some cases eventually becomes straight on its own account, seeks to allay the anxiety of the parents by telling them that the child "will grow out of it." Thus treatment is delayed, and valuable time is lost. Again, because teething, an acute illness, a fall, etc., act as predisposing causes of squint, it is said that when such causes cease to act the squint will disappear; this is another cause of delay. Yet another is the disinclination of both parents and practitioner to put a child into glasses until it can no longer be avoided. Even at the present day such pleas for delay are constantly heard, but no graver mistake can possibly be made. *When once a squint is definitely diagnosed, there is no justification for postponing treatment.*

It should be clearly understood that there is no such thing as squinting with both eyes. Excessive convergence which is necessary to focus an object held close to the face

is not squinting, though it is often so described by the inexperienced. A squint exists only when one eye is looking straight ahead and fixing an object while the other assumes, or tends to assume, an abnormal position, either inwards, outwards, upwards, or downwards, the commonest deflection in childhood being inwards. An eye which is not so directed towards an object that the image can be focused on the macula can never have full vision, even though some other portion of the retina develops a false macula. An eye which is abnormally deflected will therefore gradually lose its visual acuity, the loss being greater the earlier in life the deviation occurs and the longer it is allowed to remain. It follows that when a squint, by the application of the recognized tests, is definitely diagnosed, the sooner vigorous steps are taken for rectifying the defect the better. No age is too early to begin treatment, but of course in the case of infants it is not always easy for the comparatively inexperienced to be sure whether a true squint really exists.

We have to distinguish between four kinds of squint :

1. Paralytic.
2. Apparent (Fig. 6).
3. Concomitant (Fig. 7).
4. Latent.

It is easiest to exclude **paralytic squint** first. This is done by moving the eye in different directions, so as to test the actions of the various muscles. The patient is asked to follow an object moved through the field of vision, then the movement in some particular direction is restricted, and at this point the patient will complain of diplopia, the symptom which has no doubt led him to seek advice. In more obscure or incomplete cases the method of testing with a candle moved across the field of vision, while the patient wears a pair of spectacles with a red glass in front of the right eye and a green glass in front of the left, should be employed (*see* p. 33) ; the relative positions of the two images can thus be more accurately

worked out, and the separation between the two will be greatest when the candle is moved in the direction in which the paralysed muscles ought to act. In paralytic squint the secondary deviation is greater than the primary. This means that when the eye with unaffected muscles is covered, and the affected eye endeavours to look in the direction in which the paralysed muscle ought to act, the eye that is screened will be seen to make an exaggerated overaction in the same direction and thus

Fig. 6.—Apparent squint.

assume a position of greater deviation than exists in the affected eye when both are uncovered. The opposite is true of concomitant strabismus.

Next we have to decide whether we are dealing with an **apparent** or a **concomitant squint.** A concomitant squint is one in which the relative deviation of the two eyes maintains the same relation to each other in whatever position the eyes are turned, and the secondary deviation is equal to the primary. Get the child to fix an object placed straight in front of him, about 2 ft. away from the face in the middle line, at an equal distance between

the two eyes ; then decide which eye appears to deviate ; this eye is not fixing the object, and vision is being carried on entirely by the other. Now cover with a card the fixing eye and ask the child still to observe the object ; in order to do this with the deviated eye a movement must be made for the purpose of bringing it into line with the object. If this movement occurs in the squinting eye, then we can pronounce the case to be one of real squint, whereas if no movement takes place, we are justified in assuming

Fig. 7.—True squint.

that the squint is only apparent. The one exception to this rule is when the vision has become so bad in the squinting eye, probably from neglect, that no steady movement takes place, the eye having lost all power of fixing an object ; it therefore remains in the same position without making any attempt to change its position. Still, as a practical working method the test answers very well, and is trustworthy. Sometimes when the fixing eye is covered the child feels resentment and tries to remove the screen, showing that the vision in the squinting eye is so far below normal that he prefers the vision afforded by the fixing eye.

An apparent squint occurs in the following way. In a normal eye, the optical axis, a line drawn through the centre of the cornea and the centre of the eyeball in an antero-posterior direction, would not strike the macula but some point between the disc and the macula; the visual axis, as an imaginary line starting from the macula and drawn through the centre of the eyeball, would not pass through the centre of the cornea but slightly to the temporal side of this point, and thus the visual axis and the optical axis make a small angle at the axis of rotation of the eyeball, called the angle γ, the position of rest of a normal emmetropic eye being therefore one of slight divergence. This angle may vary in many instances, so that there may be excess of apparent divergence in one case or even apparent convergence in another.

Although the deviation in squint may be in any direction, it is generally either convergent or divergent; and concomitant strabismus is due to a combination of causes and not one cause alone. The two chief causes present in children who have a tendency to squint are: (1) Disturbance of the normal co-ordination of the ocular muscles, or imperfect muscle-balance co-ordination; (2) defective fusion sense, or imperfect binocular vision, whereby the eyes tend to be used separately rather than together. The predisposing cause which precipitates the squint is generally a refractive error which in the presence of the other two causes is sure to bring about the deviation of one eye; but often the muscle-balance is not definitely at fault, though unstable, and the occurrence of teething, measles, or a fall on the head conduces to a positive in-co-ordination, and a squint becomes manifest.

It is important, however, to remember that the degree of squint bears no direct relationship to the amount of refractive error, some patients with a very low degree of error having pronounced strabismus, whilst others with a high degree of error do not squint at all.

A concomitant strabismus, either convergent or divergent, may be an alternating one ; in other words, it is immaterial to the child which eye is the fixing one ; but in any case one eye alone is used at any one time. These cases are said to be more difficult to cure.

In all cases of concomitant convergent strabismus the outward movements ought to be complete in both eyes.

Treatment.—The ideal results to aim at in treating cases of **concomitant strabismus** are : (1) Perfect vision in both eyes. (2) Parallelism of the visual axes. (3) Good binocular vision of the third grade, viz. estimation of perspective.

It is important that the treatment should be carried out in the order I am about to describe ; some practitioners are fully acquainted with the different methods, but use them in the wrong order and so fail to achieve success.

Since refractive error is the commonest predisposing cause, this must be dealt with first, and if the child is old enough to read, the vision *in each eye separately* must be accurately taken and recorded ; the error must then be corrected by retinoscopy under atropine (atropine ointment 1 per cent. three times a day for a week) and suitable glasses ordered for constant wear. It is generally found that the squinting eye has the greater error of refraction and the lower visual acuity of the two. If he has had considerable experience in refraction work, the practitioner may order these glasses and carry out the first step in the treatment on his own account, and if, or as soon as, the child is able to read letters, a periodical record of the vision in each eye, especially the squinting one, must be carefully kept. No matter how accurately the glasses have been measured, if they fail to correct the deviation in the squinting eye when regularly worn, there is the same danger of permanent amblyopia occurring as if the glasses had never been ordered. In such cases, therefore, and in infants who are not able to read and whose

visual acuity cannot be properly recorded, special attention must be paid to the education of the vision of the squinting eye. For this purpose a separate pair of glasses must be ordered with a black goggle instead of the glass for the fixing eye, and these must be worn for a definite period (four or five hours every day) in order to force the child to use the squinting eye regularly and thus train it. Another plan is to cover up the fixing eye beneath the glasses, which has the same effect, though this method is not quite so satisfactory as that of a well-fitting goggle. Under this treatment the squinting eye generally improves, and becomes useful immediately it assumes the straight position.

In *convergent strabismus* the refractive error is generally in the nature of hypermetropia, with or without astigmatism, and therefore, as explained under Refraction, accommodation is necessary to obtain a clear image of an object on the retina, even for distance. This excessive accommodation is accompanied by excessive convergence, which constitutes the muscle inco-ordination in these cases. Convergence is not necessary for distant vision, with the result that the image of a distant object is thrown on to non-corresponding parts of the retinæ, and thus, in the presence of defective fusion sense, a squint is produced.

In convergent strabismus glasses are given to relieve the excess of accommodation. As accommodation and convergence are so closely associated that they cannot very well be separated, it is hoped that by relieving the accommodation the excess of convergence will disappear and the eyes become straight. The deviation, however, is not always corrected at once, and it is better to wait at least a year before deciding definitely whether glasses will succeed in bringing the eyes straight, in the meantime taking care to educate the vision of the squinting eye. If at the end of this time there is no improvement, it generally means that the case has not come under observation early enough, and that the muscles which by their action

have contributed to produce the deviation have become permanently fixed and contracted. It is necessary, therefore, to deal with the offending muscles, and so we proceed to the second stage in the treatment of squint, viz. operation on the muscles in order to alter their attachment in relation to the axis of the eyeball. When this stage is reached, I strongly advise the general practitioner to surrender the case to an ophthalmic surgeon.

Nothing sounds easier than to perform a tenotomy on an over-contracted muscle, and indeed it may be considered a perfectly simple operation, even for those not specially adept in ophthalmic surgery; but the effect, both immediate and remote, of a tenotomy or any operation on the ocular muscles is so variable that it is never safe to prophesy exactly what is going to happen. The type of operation suitable in any individual case is often a matter requiring careful and reasoned judgment, and if a tenotomy happens to be unsuccessful the practitioner may find himself faced with the necessity of deciding what is to be done next without having any clear idea of the appropriate procedure.

A question commonly asked by patients is whether, after the operation, the child will still have to wear glasses. The answer is yes, especially in young people. The operation is performed merely to weaken the power of the converging muscles, but if the glasses are discarded afterwards, accommodation will again have to be called into play, and with it the muscles of convergence, and it is possible that the internal rectus muscle may become contracted as badly as before the operation.

As soon as the eyes have been brought practically straight, either by means of glasses or by operation, we are in a position to undertake the next and last stage in the treatment, viz. the education of the fusion sense, or binocular vision, which, as I have said before, is always defective. This is accomplished by means of some form

of stereoscope or amblyoscope, but, of course, it cannot be commenced until the child is old enough to interpret properly the pictures shown to him.

There are three grades of binocular vision, and we must not rest satisfied until we have proof that the third grade has been reached.

First grade.—Two separate halves of one picture are placed in the stereoscope; if they are seen correctly, it will be described as one whole picture, whereas if the eyes are not used together, each half will be described as an imperfect picture.

Second grade.—Two separate halves of one picture are presented to the child, the inner halves of both being exactly similar; if they are seen correctly, they will be described as one picture, but if not, each one will be seen alternately.

Third grade.—Various geometrical figures are placed in the stereoscope; if seen correctly they are appreciated and described as objects with definite dimensions, i.e. they have depth and shape and form (sense of perspective).

When the squinting child has both eyes straight with glasses, normal and equal vision in each eye, and third-grade binocular vision, we can safely say that the squint is cured and not likely to recur, but the cure can only be said to be partial if it falls short of this standard.

The general practitioner must be perfectly familiar with all these various steps in the treatment of squint if he is to give sound advice.

Divergent strabismus can be discussed on lines similar to those of convergent squint. It is generally met with in cases of myopia. In this condition there is no stimulus to convergence, since near objects are focused on the retina with little, if any, effort of accommodation, and in high degrees of myopia sufficient convergence to see with both eyes together is impossible because the far point is so near the eye that the nose prevents the object being brought

close enough. The defective muscle co-ordination is therefore in the region of weak convergence, where the abductor muscles are relatively stronger than the adductor.

The various steps in the treatment of divergent strabismus are carried out similarly to those for convergent strabismus.

It should be added that not all myopes squint, any more than do all hypermetropes, because defective muscle-balance is not always present, nor is binocular vision always weak.

Lastly we have to consider **latent squint,** in which, as the name suggests, the deviation is not apparent so long as both eyes are in use and have equally good vision. Here the muscle co-ordination is defective but the sense of binocular vision is good and strong, so that any tendency towards the development of malposition due to the former gives rise momentarily to double vision, which is immediately counteracted by an increased stimulation to muscular action prompted by the good fusion sense, so that the muscle inco-ordination is at once readjusted. But this abnormal increased muscular effort has to be exercised all day, as long as both eyes are open, and in some cases the effort cannot be sustained without causing eyeache and headache. Both eyes must have equally good vision, otherwise the stimulus to binocular vision cannot be originated, for if the visual acuity differs in the two eyes, the images of objects are so different that no true diplopia exists. This fact is the basis of the various tests which are applied for the detection of latent squint. When one eye is completely blind, there being no stimulus to muscle co-ordination, this eye will occupy a position of deviation according to the direction in which it is drawn by the strongest muscle. It is for this reason that some blind eyes pass permanently into a position of convergence, divergence, etc.

The **symptoms** complained of are headaches lasting all day, not especially related to the use of the eyes for near work, and due to the constant strain of the relatively weaker muscles ; temporary diplopia, especially when the patient is tired, or after a severe illness, owing to a momentary failure of the same set of muscles. In extreme cases, in reading, two parts of a line of print may appear to occupy different levels.

The **diagnosis** is not difficult if the practitioner has the special apparatus at hand for detecting the weakness. One of the commonest methods is that of the Maddox

Fig. 8.—Maddox rod.

rod (Fig. 8), a series of cylinders fixed in a frame so that it can be conveniently slipped into the slot of the trial frame. If the rod be made of red glass, it will produce the image of a red line when a light is viewed through it at a distance of 6 metres, and if the other eye is kept open at the same time, one eye will be looking at the red line and the other at an ordinary light. In these circumstances there will be no stimulus to fusion, since the images before the two eyes are dissimilar. If there is no muscle inco-ordination the image of one eye will be superposed on that of the other, but if there is any latent squint there will be a narrow or wide separation between the two images according to which set of muscles is the stronger and the degree of

their over-action. It is best so to place the rods as to bring out a horizontal line, i.e. they should be vertical in testing the upward and downward movements, and in the horizontal position to bring out the vertical line when testing the external and internal movements. If a Maddox rod is not handy, simply cover one eye with a screen; this effectually destroys binocular vision, and it will be observed that the eye behind the screen has changed its position, to be quickly restored, as soon as the screen is removed, by a rapid movement made to counteract the otherwise temporary diplopia which occurs. This movement can be detected if the eye which has been covered is carefully watched immediately the screen is removed.

Since this kind of squint has nothing to do with refractive errors, though these may possibly coexist, **treatment** must be carried out on lines different from those for ordinary squint. It consists in exercises, the use of prisms, or operation on the muscles; but the advice to be given in these cases requires a good deal of judgment, and they should be handed over to an ophthalmic surgeon.

CHAPTER XVIII

ERRORS OF REFRACTION AND ACCOMMODATION, AND EYESTRAIN

About 60 per cent. of all cases of defective vision and eyestrain are accounted for by errors of refraction, and symptoms are generally relieved and vision improved by the wearing of suitable glasses.

There are two ways of arriving at the actual correction, viz. by retinoscopy, which can be carried out independently of the patient's help, and by subjective testing, in which we have to rely on the patient's assistance. By combining the two methods the proper glasses can be satisfactorily determined. But even when both methods are thoroughly mastered, which takes a considerable time, one's difficulties are by no means at an end, for it is necessary to make the patient comfortable in his glasses for everyday use, to answer all his questions about the wearing of them, and to deal satisfactorily with the complaints so often made when glasses are first used.

The prescribing of glasses consumes so much time that most general practitioners who attempt it soon give it up. One who is disposed to undertake such work will find the guiding principles set out in the following pages; those who prefer not to do refractions—and they will probably form the majority—should none the less be familiar with the rudiments of the subject, for no case of this kind can be properly investigated without such knowledge, and they will save themselves a good deal of uncertainty in making the diagnoses if they can detect the "shadows" in hypermetropia, myopia, and astigmatism.

It is not uncommon for a patient to come complaining

that he has lost the sight of one eye " quite suddenly " ; this may or may not be a fact : a refractive error giving rise to lowered visual acuity may be discovered accidentally, in which case the *sudden* loss of sight is only apparent. Without careful examination the practitioner cannot tell whether this is the case, or whether there is some disease which has occasioned sudden loss of sight. A knowledge of the elements of retinoscopy helps to clear up any doubt on this point without being strictly accurate in its results, and a correcting glass may be all that is necessary in what otherwise appears to be a serious case.

1. Errors of Refraction

To understand errors of refraction, it is necessary to recall the elementary principles of the normal static refraction of the eye. Parallel rays of light, i.e. rays of light from a distance of 6 metres and beyond, are focused on a normally situated retina, and an object becomes visible at this distance *without any focusing effort whatever.* Near objects reflect divergent rays which can only be brought to a focus by increasing the refraction of those rays before they reach the retina ; this is accomplished by an effort of accommodation. Any departure from this normal state in relation to distant objects constitutes an error of refraction, and any failure to focus accurately objects at close range constitutes an error of accommodation.

Errors of refraction are usually of three kinds—hypermetropia, myopia, and astigmatism.

Hypermetropia, or long sight, occurs when the eyeball is too short in its antero-posterior diameter, so that parallel rays of light cannot be focused on the retina but tend to form an image behind it. An effort of accommodation of the necessary amount brings parallel rays of light to a focus, and therefore such eyes are obliged to accommodate for distance, which is not normal ; moreover, the intraocular muscles are never at rest unless the eyes are closed.

This does not mean that a hypermetrope has any greater capacity for observing distant objects than a normal person, but only that one uses the accommodation while the other does not.

In *myopia*, or short sight, the eyeball is too long, and therefore parallel rays of light come to a focus at some point in front of the retina. Such eyes are adapted for the reception of divergent rays, which occurs when they look at near objects, and therefore patients with myopia have no difficulty in seeing at close range: it is only a question of range and a certain amount of relaxation of the accommodation which would otherwise be necessary in the normal eye; but they are never able to see well in the distance without glasses, since there is no mechanism in the eye which can adjust the focus successfully. Myopes use their accommodation far less than hypermetropes or emmetropes (normal-sighted persons).

Astigmatism exists when there is inequality in the radii of curvature of the various meridians of the cornea; this generally resolves itself into difference in two principal meridians, which are usually at right angles to each other, though not necessarily vertical and horizontal.

Irregular astigmatism occurs when a number of meridians have different lengths of radii of curvature; this error can never be corrected.

The cornea is chiefly responsible for astigmatism, though the lens sometimes gives rise to it.

Astigmatism may be hypermetropic, myopic, or mixed (hypermetropic in one meridian and myopic in the other).

Convex (or +) glasses are given for hypermetropia, concave (or −) glasses for myopia, and cylinders for astigmatism.

Convex glasses increase the refraction of the rays before they reach the retina, and so save the accommodation necessary in hypermetropia.

Concave glasses render the parallel rays of light diver-

gent before they reach the cornea, thus simulating rays of light coming from near objects; they can therefore be focused on the retina of a myopic eye.

Cylinders only refract rays of light passing through them at right angles to their axis, so that, an error of refraction having been corrected up to a certain point with spherical lenses, the uncorrected meridian can be adjusted by the addition of a cylinder placed with its axis parallel to the meridian already corrected.

Hypermetropia and astigmatism are usually congenital, and the degree is not generally influenced by any of the so-called causes of eyestrain.

Myopia, on the other hand, develops in normal or even hypermetropic persons as a result of improper use of the eyes coupled with a lowering of the general health. Heredity plays an important part, and myopia is a common sequel of corneal opacities due to ulceration.

This error of refraction is also found in swelling lens, cyclitis, conical cornea, and diabetes.

Symptoms.—Errors of refraction give rise to blurring of the sight for distant or near objects, or for both, and the degree of dimness of sight varies in different cases. Some patients complain of eyeache and headache due to eyestrain (*see* p. 174).

Not all errors of refraction give rise to symptoms, and so long as vision remains fairly good for all ordinary purposes, even gross refractive errors may pass unnoticed. By means of the intrinsic muscles of the eye the focus can be so adjusted that vision is considerably improved by an effort of accommodation, and although the vision may not be quite up to normal, eyes with $\frac{6}{12}$ or $\frac{6}{9}$ vision can be utilized in ordinary life much in the same way as the normal eye. On the other hand, the smallest errors often give rise to severe eyeache and headache, symptoms which must be genuine since they are immediately relieved by wearing correcting glasses; moreover, such errors

are said to be responsible for a most complicated train of symptoms, many of which appear to have nothing whatever to do with the eye. The fact remains that there is no constant relationship between the degree of refractive error and the severity of the symptoms.

Theoretically, in *hypermetropia* there should be blurring of the sight for both distant and near vision, but there may be no symptoms at all so long as the patient is young, and able to make, without feeling it, the increased accommodative effort necessary for accurate vision. It is only after some severe illness followed by muscular weakness, or in people with chronically lowered tone, or after the age of forty-five, that the sight becomes blurred and symptoms of eyestrain make their appearance—most marked for near work.

In *myopia* there are no symptoms of eyestrain, as a rule, though occasionally spasm of accommodation occurs, which is followed by headache. The only symptom is defective vision in the distance, though patients are not always aware of it. They frequently state that they do not wish to see any better in the distance, even when it has been proved to them that they can see better with correcting glasses.

In reading, needlework, etc., the object is held very close to the eyes, but we must not rely too much upon this. Even normal children hold their books close to their eyes in order to obtain a larger image, and it is only excessive nearness that is worthy of notice. Myopes cannot read unless they do this, and holding the book close, together with defective distant vision, is practically conclusive. Progressive myopia, always possible in any case, and aggravated by near work according to the views generally accepted at the present time, is a danger to be reckoned with ; it leads to rapid ectasia of the posterior pole of the eye and results in stretching and splitting of the retina and choroid at the macula.

In *astigmatism*, headaches and eyeache are common, vision is generally below normal, and the slightest errors often give rise to most worrying symptoms, there being more strain on the ocular muscles in these cases than in simple axial defects.

Chronic conjunctivitis, ciliary blepharitis, etc., often fail to respond to treatment owing to the presence of errors of refraction, although there are not necessarily any definite symptoms of eyestrain, and correcting glasses must be worn.

The **diagnosis** of errors of refraction is made by the method of retinoscopy and by subjective testing with glasses, both of which ought to be employed. Those inexperienced in retinoscopy can only use the subjective method, which by itself is not altogether reliable, especially in mixed astigmatism.

The principle of **retinoscopy** is that rays of light reflected into an eye from a mirror will be reflected back from the retina and emerge according to the refraction of that eye. Therefore in emmetropia the rays will be parallel, in hypermetropia divergent, and in myopia convergent.

The examination is conducted in a dark room, either with or without a mydriatic. In children it is almost always necessary to use atropine, since they often have a considerable amount of latent error which must be corrected, but which cannot be properly estimated unless the accommodation is thoroughly paralysed while the retinoscopy is being carried out. In adults a mydriatic must be used unless the vision can be brought to $\frac{6}{6}$, and in such cases homatropine with cocaine (2 per cent. of each) is the one in common use. It is not suitable, however, for young people, as in them the tone of the ciliary muscle is too strong to be overcome by so weak a mydriatic, but it is more convenient for adults, as it produces paralysis in about half to three-quarters of an hour, and the effects pass off in about thirty-six hours. For precautions in

the use of it, *see* p. 39. There is a prejudice in the minds of many general practitioners against the use of a mydriatic in people over 40 years of age, because it is said that its use may induce an attack of glaucoma; but any contra-indications in this respect have been discussed elsewhere (p. 39).

The "shadow test" is carried out in the following way. Let the patient be seated on a chair in a dark room with his back to the light. Place the light just above the head a little behind the forehead so that the face is in the shade; you then sit down in front of him at a metre's distance. Retinoscopy can be conducted at any distance, but this is the most convenient, because at this distance the glasses can be conveniently adjusted in the trial frame during the examination. If the patient be under a mydriatic, direct him to look at your forehead just above the right eye, and if not, to look into the distance just beyond and close to your head. Put the trial frame on his face and block out one eye so that the examination of each eye can be made separately. Hold the mirror (a plain one for choice, as the shadows are easier to see) up to the eye so that the latter is close up against the sight-hole (after correcting any error of refraction which you may have), and then throw the light into the eye and observe the red reflex (*see* p. 19). This will be bright in the normal-sighted or in low errors of refraction, whether hypermetropic or myopic, but will be dull in high errors of either kind, and also when there are opacities in the media. Now move the light slowly across the pupil by tilting the mirror, still keeping the eye close behind the sight-hole; the light will be seen to pass across the pupil, and the shadow formed by the crescentic or straight line of demarcation between the light reflex and the dark will be seen to travel across the pupillary area (Fig. 9).

Now the direction in which this shadow moves indicates the kind of refraction error. If a plain mirror is used the

shadow in emmetropia, hypermetropia, and low myopia (i.e. less than 1 D) moves in the direction in which the light moves; in myopia it moves in the opposite direction.

The object is to find the point of reversal, and this will be the case when the rays of light come to a focus on the nodal point of the observer's eye; the image of the pupil is then so bright that no shadow is formed when the mirror is tilted; and this point is arrived at by putting up correcting glasses, which are + (or convex)

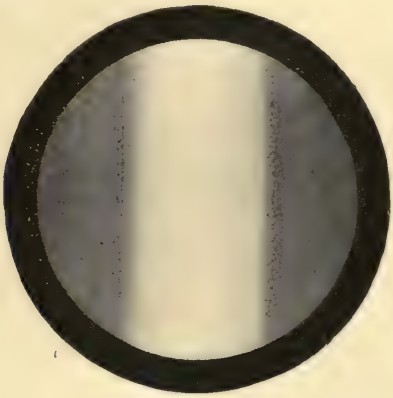

Fig. 9.—Retinoscopy shadow.

when the shadow is moving in the same direction as the light, and − (or concave) when in the opposite direction.

It is important to get into the habit of paying attention to the central part of the pupil, since it is through this part that the patient will afterwards see, and the spherical aberration through the peripheral part of the lens often modifies the shadow, which is therefore rather different here from what it is in the central part.

Astigmatism is shown when one meridian is corrected by a certain glass which is not sufficiently high to correct the other. Mixed astigmatism is present when the shadow moves in the same direction as the mirror in one meridian

and in the opposite direction in the meridian at right angles to it.

High errors give a dull illumination, and the shadows on this account are difficult to detect, but by putting on a high glass, first plus and then minus, the brilliancy is either improved or made worse, and thus we are able to tell at once whether the glass we are putting up is of the right value ; if neither a high convex nor a high concave glass reveals the presence of a distinct shadow one way or the other, we are probably dealing with a case in which there is some opacity in one of the media ; if so, retinoscopy becomes impossible, and we have to rely upon subjective testing for improving the sight, or upon treatment to remove the opacity. Since the rays of light must be brought to a focus at the nodal point of the observer's eye, which is at a distance of 1 metre, we have to deduct 1 D from all plus corrections and add 1 D for all minus corrections, because in the first case the rays of light are brought down from parallelism to focus at 1 metre, and in the second case we stop short of parallelism by bringing them to a focus at 1 metre's distance. This addition or deduction is made merely because it is more convenient to sit at 1 metre's distance ; if we sit $\frac{1}{2}$ metre away, 2 D must be deducted or added on, and if 2 metres, $\frac{1}{2}$ D, and if retinoscopy were possible at 6 metres the glass which neutralized the shadow would be the actual correcting glass, and no addition or deduction would be necessary.

Variations in the shadows occur under certain conditions. I have already alluded to the brightness of the illumination when nearing the point of correction, and to the dark illumination in high errors, and incidentally in opacities in the media ; but in some cases there appear what are called " scissor movements." This means that, when the light is moved across the pupil, shadows come from all directions, and no definite meridian can be isolated from any other because the shadows all counteract each other ;

it is the sign of irregular astigmatism, which, as I have said, cannot be corrected by any glass.

Band-like shadows are seen in high astigmatism, and the direction of the axis of the cylinder is then plainly visible. In ordinary simple astigmatism, it is usual to correct one meridian with a spherical glass, and, having accomplished this, to disregard the corrected meridian and keep the attention fixed on the meridian at right angles to it and try higher spherical lenses until the correcting glass for this is found. Mixed astigmatism is corrected in the same way, but in this case the spherical lens put up for the correction of one meridian intensifies the shadow in the one at right angles to it, and this really simplifies the correction, though the subsequent calculation from the figures must be very carefully made.

Subjective testing is an excellent substitute for retinoscopy; with the expenditure of a little time and patience it can be carried out in the following way:

Place the patient at 6 metres from an ordinary Snellen's test-type card, or at 5 metres with a 5-metre card, and test each eye separately, using a trial frame. Ask him to read the letters as far as he is able; if he is able to read $\frac{6}{6}$ he is either emmetropic or hypermetropic; if a small convex lens be placed in the trial frame the emmetrope will be unable to see the $\frac{6}{6}$ line properly, but the hypermetrope will see just as well, and the amount of the hypermetropia can be measured by estimating the highest glass with which the patient is able to see $\frac{6}{6}$.

If he can only read some of the letters, record the line he stops at (say $\frac{6}{12}$), and then put up a low convex lens in the trial frame and see if it enables him to read a smaller type; if it does, go on gradually increasing the strength of the lens until he is able to read $\frac{6}{6}$ (or $\frac{5}{5}$), and again notice the highest glass with which he can read the last line. In some cases, especially in children, there is still some additional hypermetropia, which is "latent," due to the

tone of the ciliary muscle, and the amount of this can only be estimated by paralysing the accommodation with a mydriatic before applying the test.

If spherical lenses only improve up to a certain point (say $\frac{6}{18}$) and no further, put up the lowest convex glass with which he could see $\frac{6}{18}$, and add convex cylinders, first placing the axis vertical and then horizontal, and finally in various intermediate meridians; by this means the axis of the astigmatism can often be determined and the vision improved to $\frac{6}{6}$. If no spherical glass brings about any improvement, cylinders alone can be tried.

If no convex glass of any kind or combination of such glasses improves the vision, concave glasses may be tried in the same way, always remembering that for many reasons they are never so reliable as the convex ones. There is risk of over-correction, though this can be avoided to a certain extent by more than one method, e.g. by asking definitely whether an increase in strength of glass beyond the one which gives $\frac{6}{6}$ diminishes the size of the letters, which indicates over-correction.

If the correcting glasses have been estimated by retinoscopy, they must immediately be verified, when possible, by subjective testing. Deduct 1 D from every plus correction and add 1 D to every minus correction to allow for the distance (1 metre) between the patient and the surgeon when conducting the retinoscopy; this will give the spherical glass. Then, if there is any simple astigmatism, subtract the correcting glass of one meridian from that of the other and place this up in the trial frame with its axis parallel to the meridian already corrected; great care must be exercised in finding this angle. The patient then presumably gets $\frac{6}{6}$. In hypermetropia and hypermetropic astigmatism, 1 D more must be deducted for the tone of the ciliary muscle, which will return as soon as the influence of the mydriatic has passed off, but the amount to be deducted varies with different patients, since the

cause is a physiological one, and also with the degree of hypermetropia.

Treatment.—The main principles governing the prescribing of glasses are the following :—

In *hypermetropia* give the highest glass that the patient can take binocularly and still see $\frac{6}{6}$ (*see* later).

In *myopia* give the lowest glass which the patient can take binocularly and still see $\frac{6}{6}$.

Theoretically, cylinders should never be altered, but as a matter of experience it will be found that in high cylinders a little lower than the full correction will be more comfortable, especially when glasses have never been worn before. Greater care than ever must be exercised in finding the exact axis of a high cylinder.

In hypermetropia it is sometimes found that glasses considerably below the full correction have to be ordered ; especially is this the case in high errors ; and although the object is to relieve as much as possible excessive action of the ciliary muscle, which is responsible for the symptoms, this cannot be attained all at once. In these circumstances, order the glass as near the full correction as possible, and after a few months examine the patient again and see if a slight increase in the strength of the lens can be tolerated. In this way the tone of the ciliary muscle can gradually be overcome, until the full correction is reached.

In myopia it is hardly necessary to make any alteration from the retinoscopy correction, except for the addition of 1 D, due to the distance at which the surgeon sits. There is far less tone of the ciliary muscle than in hypermetropes, and sometimes an actual atrophy of the ciliary muscle from disuse has been observed.

When there is a great difference in the refraction of the two eyes, e.g. a $-$ 6 sph. in one eye and a $+$ 2 sph. in the other (*anisometropia*), the full correction cannot be ordered even though both eyes see $\frac{6}{6}$ separately, because the images are so different in size that fusion is impossible,

and binocular vision only creates confusion. At the same time, as this is due to physiological causes, patients vary greatly in the amount of anisometropia that they can bear, and if the difference is not more than 6 D or 8 D, the full correction may be attempted.

After *cataract extraction*, glasses must be worn, and in many instances if there is a good hole in the capsule, a retinoscopy can be carried out, but in other cases subjective testing must be relied upon; a horizontal cylinder is generally necessary in addition to the sphere.

In *conical cornea*, refraction is impossible, and subjective testing must be resorted to. Very high cylinders are generally necessary; the usual correction being a high minus cylinder with axis vertical.

Advice to be given to patients wearing glasses.—In *hypermetropia* and *astigmatism*, since there is generally headache and eyeache, especially after reading and near work, the patient must be advised to wear glasses for reading, writing, and sewing, and not to be misled by the fact that they can see as well without the glasses as with them. Explain that although the vision remains the same, the eyes, without glasses, are always under a strain, which is relieved when glasses are worn. If in spite of wearing glasses for near work the eyestrain persists, then glasses must be worn constantly. So also when there is any tendency to chronic conjunctivitis or blepharitis. After the age of forty-five both distance and reading glasses are necessary, and may be combined in the form of bifocal lenses. Patients supplied with combination glasses must be warned that in going downstairs the head must be slightly bent so as to ensure looking through the upper division of the glasses.

In *myopia*, glasses should be worn constantly, but many short-sighted patients are very averse from wearing them. Their defective distant vision does not seem to trouble them, and since they can read any print quite

comfortably without glasses, it is very difficult to convince them that glasses are necessary. Unfortunately, many people regard short sight as an advantage rather than otherwise, and refuse to believe that any serious consequences can possibly ensue from the irregular wearing of glasses. It is true that no real harm can result from not using glasses for distance, but without glasses the range for near work is sure to be too close, and such sustained action of all the ocular muscles tends to progressive myopia ; moreover, the constant wearing of glasses encourages a more natural use of the eyes. If any great opposition is manifested, the dangers of progression should be pointed out.

Patients under forty-five who have myopia can read quite easily without glasses ; after that age the presbyopic convex lens, which is generally necessary, is partly counteracted by the myopia, and they are still able to read unassisted, since they practise less accommodation than normal people, and so on up to the age of sixty or seventy, according to the degree of myopia. Comparing themselves with others, who are probably normal presbyopes, they consider themselves in a much more favourable position, and draw the conclusion that their eyes are very strong ; this is the origin of the fallacious notion that the eyes of short-sighted people become stronger as they grow older. Such myopes fail to notice that their distance vision remains as imperfect as it was before. As progressive myopia is more likely to occur in youth, when the tissues are elastic and more liable to stretching, these patients have merely succeeded in escaping the dangers which might have injuriously assailed them in their earlier life.

2. Errors of Accommodation

The commonest of these errors is the failure of accommodation at the age of forty-five, which is physiological and due to sclerosis of the lens, so that it fails to expand when

the ciliary muscle is put into action. Being a physiological change, it varies in different persons at the same age, and therefore no hard-and-fast rule can be laid down as to the strength of the convex glass necessary to counteract this failure It is generally laid down that + 1 D is required at forty-five, + 2 D at fifty, + 3 D at fifty-five, and + 4 D at sixty and over. As a matter of practice, it will be found that from the age of fifty onwards a slightly lower strength than those mentioned is more comfortable. Some patients do not enter the presbyopic age till they are forty-eight or even fifty, and are quite well able to read without glasses up to that time.

If stronger glasses are ordered than are required, the effect is to compel the patients to read at close range, thus straining the convergence, which, we must remember, gets weaker *pari passu* with the accommodation, and for this reason complaints are made of "drawing of the eyes." This should continually be borne in mind when ordering glasses for presbyopia. The rule is to order the lowest convex glass that enables a patient to read the smallest print (Jaeger 1) at a distance of 18 inches.

Distant vision must always be recorded first, and any glass necessary to bring the vision up to $\frac{6}{6}$ must be taken into account; if a convex lens is required, as in hypermetropia, this must be added to the presbyopic correction, and if myopia is present a deduction must be correspondingly made.

Another error is *paralysis of accommodation*, which occurs, as is well known, after diphtheria, and some other acute illnesses. This is not evident when testing distant vision, but is immediately obvious when the patient is asked to read.

Spasm of accommodation is fairly common, and is met with in all forms of refractive error, even in myopes. It is a troublesome symptom, and is associated with a good

deal of neurasthenia, which aggravates the condition. Such cases are difficult to treat; the patient is always thinking that his glasses are wrong, and is apt to go from place to place to have trivial changes made. With patients of this type it is best to do the refraction with special care under a mydriatic, and to encourage them to wear the glasses regularly. If their symptoms are not relieved, it is better to stop all near work for a time.

3. Eyestrain

By this term is denoted the asthenopia arising from the use of the eyes under certain unfavourable conditions. Eyestrain is dependent on a variety of causes, all of which may be aggravated by any lowering of the normal standard of health.

The cause of all eyestrain is fatigue and exhaustion of the muscular and nervous mechanism which controls adjustment of the sight. It may consist, therefore, in errors of refraction, muscle inco-ordination, e.g. latent squint, errors in distribution of light, and faults connected with adaptation. It is not necessarily the quality or quantity of the light which is of chief importance, for the symptoms of eyestrain may be produced by defects in the lids, pupils, etc., which affect the distribution of the light, and by variations in the amount and physiological properties of the retinal pigment, and in fixation, etc., which influence adaptation.

The commonest cause is a slight departure from the normal refraction of the eye, which, although not sufficient to produce any inconvenience for distant vision, nevertheless demands increased accommodative effort during prolonged reading or other near work. With slight errors of refraction eyestrain is often met with when the usual amount of accommodation is exercised at a time when the patient is in a weakened state of health. Thus

it follows that small errors of refraction may never be noticed until circumstances arise which require constant application to near work, or until some severe illness has weakened the general muscular tone; this accounts for the remark so often heard that the eyes were perfectly well until after an illness.

Eyestrain also occurs if wrong glasses are ordered, or if glasses rightly prescribed are worn wrongly, for an artificial degree of astigmatism is in this way often added to the error already existing.

Symptoms.—Eyeache, headache in any part of the head, but most frequently over the forehead, worse after the use of the eyes and towards the end of the day, watering of the eyes, heaviness of the lids, desire to shut the eyes for a time after reading and sewing, are the commonest symptoms; but many others are ascribed to errors of refraction which it is difficult to reconcile with any known defects of the ocular muscles, though the use of glasses apparently cures them. No greater mistake can be made than to ignore the symptoms complained of in these cases, and regard them as trivial or of no importance.

The **diagnosis** is often very difficult, as the symptoms are entirely subjective in character, and vary in different persons; a thorough and careful examination is necessary to exclude each cause in turn.

Treatment.—The first step is to correct any refractive error which may exist; retinoscopy must be performed, generally under a mydriatic, and glasses prescribed, first for reading, and later if necessary for constant wear.

It is well known, however, that the amount of asthenopia bears no direct relationship to the degree of refractive error. If the muscular inco-ordination is found to be excessive, prisms must be ordered in addition to glasses for the correction of the refractive errors. This requires considerable judgment, for no patient can tolerate prisms

if they are beyond a certain strength, and operative measures may have to be considered.

Attention must also be paid to methods of illumination and to the amount of glare, since errors in distribution and faults of adaptation call for the use of extraocular muscles, e.g. the superciliary muscles, and this often causes headache.

CHAPTER XIX

DISEASES OF THE ORBIT

DISEASES involving the orbit and its contents are not very common, though they are occasionally met with in private practice. The results are sometimes serious, and possibly dangerous to life; the general practitioner must therefore be familiar with the leading signs and symptoms.

To get a clear idea of orbital conditions, it is important to keep in mind the anatomical surroundings of the orbital cavity. For instance, the antrum below and the ethmoidal sinuses on the inner side are fruitful sources of inflammation, and when these cavities become swollen and distended with pus they may easily encroach on the orbit and indirectly affect the eye.

The commonest orbital diseases are—(1) periostitis of some of the bony walls, (2) orbital cellulitis, (3) inflammation of Tenon's capsule (tenonitis), (4) thrombosis of the cavernous sinus, (5) exophthalmic goitre, (6) new growths.

Periostitis of any of the bones enclosing the orbit is similar to periostitis anywhere else in the body, and the causes are the same. It often leads to the formation of pus, which finds its way into the orbit, infecting the contents.

Orbital cellulitis is an inflammation occurring in the orbit itself, either primarily, or secondarily to some disease of the surrounding sinuses. Sometimes, but not always, it leads to the formation of pus behind the eyeball.

Tenonitis is inflammation of Tenon's capsule, the membrane surrounding the muscles attached to the globe and reflected on to the eyeball.

Exophthalmic goitre often comes under the notice of the general practitioner or the ophthalmic surgeon first, as one

eye occasionally becomes prominent some time before the other, and there are present even at this early stage all the leading signs and symptoms of the disease.

A new growth may be found occupying the orbital cavity, or may be more localized as a definite tumour of the optic nerve.

The four chief **signs** which denote an affection of the orbital cavity are (1) proptosis, (2) limitation of movement of the eye, (3) œdema of the conjunctiva (chemosis), with or without dilatation of the blood-vessels of the conjunctiva and surrounding parts, (4) changes in the optic disc and retina as seen by examination of the fundus. One or all of these signs are present in a greater or less degree, and must be carefully looked for. In some cases there is swelling, redness, and œdema of the upper lid, but this is also characteristic of severe types of acute conjunctivitis, so that, unless it is accompanied by proptosis and limitation of movement, it is not to be regarded as evidence of orbital inflammation.

Periostitis, followed by the formation of pus behind the eye, and **orbital cellulitis** give rise to much the same signs, viz. proptosis, limitation of movement, and slight chemosis, with some swelling of the upper lid. There may be much or little pain, accompanied by rise of temperature and feeling of malaise. Hot fomentations should be immediately applied and frequently repeated, but unless early improvement is manifest an incision should be made through the skin of the upper lid just below the upper orbital margin on the outer side, or perhaps at the lower margin, and sinus forceps used to dilate the opening and facilitate the exit of pus, should any be found ; a drainage-tube can then be inserted. Very often these operative measures prove effective, and the inflammation gradually subsides, leaving no sequelæ behind it, but occasionally secondary affection of the optic nerve occurs, giving rise later on to optic atrophy. It must be remembered that in

these cases there is danger of meningitis or cerebral abscess supervening ; a guarded prognosis must therefore be given.

In **tenonitis** there will be slight proptosis and some limitation of movement, accompanied by pain in extreme movements of the eyeball, due to the inflammation being near the muscular attachments, but no other signs except a little œdema of the conjunctiva. Tenonitis is due to toxic absorption from some remote focus in the body, and is very liable to recurrence. Hot fomentations and general treatment are indicated.

In **cavernous-sinus thrombosis,** proptosis will be present, but very little if any limitation of movement ; there will also be well-marked chemosis and dilatation of the blood-vessels, since the vascular and lymph-channels are mainly involved. These signs may quickly extend from one eye to the other, and some changes in the optic disc may be observed. A distinct bruit can be heard when a stethoscope is placed on the temple or over the forehead, and this often occasions a good deal of distress. Very little can be done in the way of treatment ; anything in the nature of an operation is probably better left to a surgeon.

In **exophthalmic goitre** the proptosis is most in evidence, unaccompanied by any of the other signs common to orbital conditions. The general symptoms establish the diagnosis.

In **new growths of the optic nerve,** proptosis is present, though not excessive in degree, there is no limitation of movement or chemosis, but generally some optic neuritis. The tumours can be removed by operation, but whatever method is adopted, the sight in the eye will be lost.

The eyeball may be pushed in various directions by **swelling of the surrounding sinuses,** and then the limitation of movement will be in the direction of the swelling, due to mechanical obstruction to the rotation of the eyeball, and not to any interference with the action of the muscles.

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